

Astro-Physics V2 ASCOM Driver Help File

Version no: 5.40.01

Publish date: 12/26/2021

©2021 Astro-Physics, Inc. by Astro-Physics, all rights reserved

Astro-Physics V2 ASCOM Driver v5.40.xx

©2021 Astro-Physics, Inc.

All rights reserved. No parts of this work may be reproduced in any form or by any means - graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems - without the written permission of the publisher.

Products that are referred to in this document may be either trademarks and/or registered trademarks of the respective owners. The publisher and the author make no claim to these trademarks.

While every precaution has been taken in the preparation of this document, the publisher and the author assume no responsibility for errors or omissions, or for damages resulting from the use of information contained in this document or from the use of programs and source code that may accompany it. In no event shall the publisher and the author be liable for any loss of profit or any other commercial damage caused or alleged to have been caused directly or indirectly by this document.

Printed: December 2021 in Machesney Park, IL, U.S.A.

APCC Author

Ray Galak

Technical Editors

Marjorie Christen

Ray Galak

Howard Hedlund

George Whitney

Special thanks to:

Many thanks to Ray Galak for writing APCC as well as the ASCOM driver. We also appreciate the efforts of our tireless beta testers who offered valuable feedback and suggestions and Howard Hedlund, our in-house super bug finder.

Table of Contents

Foreword	0
Part I Introduction	5
1 Version History.....	6
2 What's New.....	28
3 System Requirements.....	31
4 Installing.....	33
5 Using the Driver in a Client Application.....	39
6 Using the driver with TheSky6 by Software Bisque.....	42
7 Using the driver with TheSkyX by Software Bisque.....	48
8 Reporting Driver Problems.....	51
9 FAQ	53
Part II Telescope Setup	54
1 Mount Configuration.....	58
2 Connection Details.....	60
3 Default Park/Unpark positions.....	63
4 Site Setup.....	65
5 Telescope.....	67
6 RCAL versus SYNC.....	68
7 Advanced Options.....	70
8 Initialization Setup.....	71
9 Other Options.....	74
Part III Focuser Setup	78
1 COM Port Details.....	80
2 Focuser Backlash.....	81
3 Focuser Settings.....	82
Part IV Handbox Window	83
1 System Tray Icon.....	86
2 Top of Handbox.....	90
3 Mount Information.....	95
4 RA/Dec Bookmarks.....	97
5 Alt/Az Bookmarks.....	99
6 Move Scope Controls.....	101
7 Tracking Rate Controls.....	103
8 Additional Configuration Settings.....	105

9	Park/Unpark Settings.....	110
10	Reticle Brightness.....	112
11	Focuser Control.....	114
12	Telescope.....	116
13	PEM.....	117
14	Site Setup.....	119
15	Meridian Delay.....	121
16	Communications Errors.....	124
17	FAQ.....	126
Part V How to...		127
1	Set an Alt/Az Park Location.....	128
Part VI Advanced Topics		129
1	Pier Side.....	130
Part VII Extra Software Applications		134
1	APJog.....	135
2	APTTimer.....	136
3	APLogZipper.....	137
4	AP Right Angle Polar Alignment Scope.....	138
Index		140

Part



1 Introduction

This help file describes how to configure and operate the Astro-Physics V2 ASCOM Telescope driver.

The Astro-Physics V2 telescope driver was completely rewritten to support the ASCOM Telescope Driver Interface standard V2.0. The driver uses a highly robust design to provide very reliable operation. It can retry commands if there is no response or if a corrupted response is detected. The driver has a powerful real-time control panel and adds many features over a typical ASCOM telescope driver.

1.1 Version History

V5.40.01 - 2021-Dec-12 Release

- Fix minor ASCOM conformance issues.

V5.40.00 - 2021-Oct-30 Beta

- Fix globalization issue with "." and "," decimal characters.
- Add King rate for CP4/5 versions VCP4-P02.08 and VCP5-P02.08 and later.
- Fix move rate issue with GTOCP3 mounts.
- Fix shrinking of drivers's main GUI window when showing all controls.

V5.30.10 - 2020-Apr-07 Release

- Fix failure to get Longitude/Latitude from APCC when APCC initializes the mount.

V5.30.09 - 2020-Mar-18 Release

- Fix Mach 2 centering rates.

V5.30.08 - 2020-Mar-05 Release

- Fix Custom Slew Rate option that was missing.

V5.30.07 - 2020-Feb-27 Release

- Fix display problem visible with GTOCP2 controller.

V5.30.06 - 2020-Feb-17 Beta

- Changed commands for each of the new centering commands.

V5.30.05 - 2020-Feb-08 Beta

- A few more changes to how slew rate values are updated in the user interface.

V5.30.04 - 2020-Feb-07 Beta

- Add log entries for button presses for centering moves.

V5.30.03 - 2020-Feb-02 Beta

- Update Rates one more time.

V5.30.02 - 2020-Jan-21 Beta

- Update Rates for GTOCP4/5 new firmware.

V5.30.01 - 2019-Dec-22 Beta

- Hide PEM controls for Mach2 / GTOCP5.
- Hide focuser controls for GTOCP4 and GTOCP5.
- GTOCP5 should not "gray out" in setup dialog.
- Update Park commands for mounts with a certain personality type.
- Use mount personality to configure parks.

V5.30.00 - 2019-Sep-10 Beta

- Added support for Mach 2 and GTOCP5 park and guider commands.

V5.21.01 - 2019-Aug-10 Release

- BUG FIX - Parking from counterweight-up position may not complete.

V5.21.00 - 2019-Aug-03 Release

- NEW OPTION - Add setting to do ASCOM asynchronous parks.
- BUG FIX - Park Alt/Az can cause a double park operation when used with APCC.
- Add additional logging for park operations.

V5.20.09 - 2019-Feb-11 Release

- BUG FIX - Unpark from Park 5 was not working.

V5.20.08 - 2018-Dec-14 Release

- BUG FIX - One more fix for European users with swapped comma/decimal.
- BUG FIX - Restore "Park to Alt/Az", which was accidentally removed when Park 5 was added.

V5.20.07 - 2018-Nov-15 Release

- BUG FIX - One more fix for European users with swapped comma/decimal.
- BUG FIX - Restore "Park to Alt/Az", which was accidentally removed when Park 5 was added.

V5.20.06 - 2018-Nov-07 Release

- BUG FIX - "Keep Mount Time Synced..." option in the Setup dialog window was not being restored.
- BUG FIX - When "Keep Mount Time Synced..." is disabled the Time field in the hand box window may be incorrect.

V5.20.05 - 2018-Nov-06 Release

- IMPROVEMENT - Out of range values now show text in yellow (instead of red) with a blue background.
- BUG FIX - Custom RA and Dec Rate values incorrectly indicated out of range (red/blue) if they were set to a non-zero value at startup.
- BUG FIX - Undid RA/Dec AxisRates change in V5.20.04 because it fails ASCOM Conform testing. According to ASCOM documentation, the rates must always be positive and assumes the negative values of the range are allowed.
- BUG FIX - Parking when already Parked will now return immediately. One possible effect of this is that you will not be able to Park to a different park position without first unparking, which wasn't required in older versions of the driver.

V5.20.04 - 2018-Oct-01 Beta

- IMPROVEMENT - Park/Unpark positions will not change because of the new Park 5 position.
- Update documentation for various features, including Time synchronization options.
- Change wording of sync time during initialization.
- BUG FIX - Change RA/DEC AxisRates from 0-5, to -5-5 degrees/sec.

V5.20.03 - 2018-Sep-24 Private Beta

- NEW FEATURE - Added Park 5

~~*** IMPORTANT NOTE: PARK/UNPARK POSITIONS MAY HAVE CHANGED IN THIS RELEASE - PLEASE OPEN THE DRIVER SETUP WINDOW TO CONFIRM PARK/UNPARK POSITIONS! (Fixed in v5.20.04)~~

- BUG FIX - Dec MoveAxis was always setting Rate=0

- Remove extra "PEC" label from the Handbox

- When Encoder tracking is enabled on encoder-equipped mounts, disable PEM Enable/Disable buttons, and hide PEM Record button

V5.20.02 - 2018-Sep-06 Beta

- Updated the driver's icon with a higher resolution version.

V5.20.01 - 2018-Sep-05 Beta

- BUG FIX - When using an IP Address the "Check Mount" button did not use the current value in the IP Address text field.

V5.20.00 - 2018-Sep-03 Beta

- **NEW FEATURE** - Driver can now communicate via TCP to the mount.

- BUG FIX - MoveAxis declination rate was 1/15th what it should have been (was causing an issue in the ASCOMPad application).

- BUG FIX - Site information was not always being correctly pulled from the database, so site latitude/longitude was not always initialized correctly.

-ENHANCEMENT - Added new option to save and restore last virtual handbox position.

-ENHANCEMENT - Added new option to disable the virtual handbox from always being on top of other windows.

-ENHANCEMENT - Updated internal links to use HTTPS: instead of HTTP: where needed.

GTOCP1 and GTOCP2 control boxes - Removed support for ASCOM DeclinationRate and RightAscensionRate.

V5.10.03 - 2017-Oct-08 Release

Note: Do not use this version with APCC v1.5 or earlier.

- BUG FIX - In Europe, because of "," and "." decimal swap, the RA value returned from the mount was sometimes considered corrupted.

V5.10.02 - 2017-Oct-07 Release

Note: Do not use this version with APCC v1.5 or earlier.

- IMPROVEMENT - Allow a range of +/- 1 second for Latitude/longitude before the driver will indicate a difference.

- BUG FIX - One more change to better detect Windows regional settings.

V5.10.01 - 2017-Sep-04 Release

Note: Do not use this version with APCC v1.5 or earlier.

- BUG FIX - Negative Time Zone values were being rejected sometimes because of the extended precision format.

- BUG FIX - Fixed potential Windows regional issues with a "," being used as a decimal point in DegreesToDMS ASCOM utility calls.

- BUG FIX - Driver not parking from CW-up position.

- BUG FIX - When turning tracking OFF while parked the driver would send a "Q" command. The driver will no longer send a "Q" command if the driver senses the mount is parked.

- IMPROVEMENT - Added 1 decimal point precision to Latitude and Longitude site information.

- IMPROVEMENT - Added a button to copy and save the mount's current latitude/longitude to the current Site.

V5.10.00 - 2017-Jul-06 Release

Note: This is the minimum required version for APCC v1.6 and later.

- BUG FIX - Increase RA/Dec/Alt/Az precision (only) for GTOCP4-equipped mounts with P01-04 or later firmware. Mounts with GTOCP3 cannot use high-precision commands because input commands to the GTOCP3 are limited to 16 characters or less.

- IMPROVEMENT - Allow users to enter rates up to 999.999x for GTOCP3 controllers with "V1" firmware and all GTOCP4 controllers.

V5.09.12 - 2017-Jun-06 Private Release

- BUG FIX - Fix validation of high-precision Dec and Altitude values.

V5.09.11 - 2017-Apr-22 Private Release

- IMPROVEMENT - Allow PulseGuide Moves up to 99.999 seconds for GTOCP4 controllers.
- IMPROVEMENT - Improved performance of move mount button presses.
- IMPROVEMENT - Reduced overhead writing to log file.
- IMPROVEMENT - Continue polling mount when Pulseguide moves are active.
- BUG FIX - Prevent possible inversion of the Dec Rate that might happen "below the pole".

V5.09.10 - 2017-Apr-10 Private Release

- IMPROVEMENT - Send RA/Dec/Alt/Az/Lat/Long commands with higher precision. Although higher precision commands are sent, a GTOCP4 with P01-04 firmware or later is required for the mount to move with increased precision.

V5.09.09 - 2017-Mar-15 Release

- IMPROVEMENT - Allow for mount responses with extended precision.
- BUG FIX - when connected via APCC, get ALT/AZ from APCC so that if a pointing model is being used the corrected ALT/AZ coordinates will be displayed by the driver.
- BUG FIX - Time Sync response from APCC was handled as having failed even if it was successful.

V5.09.08 - 2017-Jan-31 Release

- BUG FIX - Park status was not always reported correctly.

V5.09.07 - 2017-Jan-23 Release

- BUG FIX - if APCC sequence numbers get out of sync, a the response to a possibly different command could be wrongly get used. Fixed by clearing the response string when the sequence number is incorrect, so the response cannot be used. Also, cleared the internal send/receive buffers to empty all older sequence number responses. The following commands should then have the correct sequence number..

V5.09.06 - 2017-Jan-19 Private Beta

- IMPROVEMENT - the Time Zone offset in the user interface now reflects the generally accepted time zone polarity instead of the value returned from the mount.

V5.09.05 - 2017-Jan-01 Private Beta

- BUG FIX - Longitudes less than 10 degrees would not match correctly in Site info group.

V5.09.04 - 2016-Nov-12 Release

- BUG FIX - Updated use of old ASCOM DriverHelper/DriverHelper2.Util to use the newer ASCOM.Utilities.Util. The legacy version was not updating the Time Zone correctly on a time change.
- BUG FIX - Prevent Time Zone from being updated when "keep Time Synched to PC" is not enabled.

V5.09.03 - 2016-Nov-03 Beta

- BUG FIX - Fixed a case missed in 5.09.02 where a time zone less than -12 was logged as an error.

V5.09.02 - 2016-Oct-31 Beta

- IMPROVEMENT - the controller type is now shown in the main window (slight user interface changes).
- IMPROVEMENT - If the controller is a GTOCP4 then hide the backlash setting controls, since backlash is not used.
- IMPROVEMENT - When connected to APCC, the "keep time synced" feature is now delegated to APCC. If APCC has its own "keep time sync" feature enabled, it will override the same setting in the driver. If APCC has "keep time synced" disabled then the driver will be able to override APCC and enable "keep time sync" until the next time that APCC is run.
- BUG FIX - Time Zones less than -12 were not being handled correctly.
- BUG FIX - Getting ASCOM DeclinationRate no longer throws an exception when tracking is disabled.
- BUG FIX - AP1100 was missing from mount types.
- BUG FIX - Fixed several ASCOM Conformance bugs when running driver through APCC.
- **EXPERIMENTAL** - When used with APCC 1.5.0.15 and later, the driver will now use a different COM port for the user and administrator accounts, allowing two instances of the driver to connect simultaneously to APCC. This will allow a mix of applications running under the user account and "as administrator" to connect to the mount through APCC.

V5.09.01 - 2016-July-19 Release

- BUG FIX - GetAllValues was pulling entries from the old AP.INI .file instead of Settings.apdb (this is a fix for proper operation with APCC).

V5.09.00 - 2016-June-05 Release

- IMPROVEMENT - Improved robustness of the driver starting APCC and auto-configuring the COM port.
- IMPROVEMENT - Improved robustness of the driver opening the correct APCC virtual port.
- BUG FIX - Site latitude/longitude was not matching the mount if leading zeros were not used. The driver now autoformats the latitude and longitude with leading zeros if needed.
- BUG FIX - Under certain circumstances when parking from a counterweight up position the driver was not able to stop the initial slew to a counterweight down position, resulting in a potential equipment collision.
- BUG FIX - Force Meridian Delay to 0 before unparking (Rev S or later).

V5.08.09 - 2016-May-22 Release

- BUG FIX - Throw error immediately if COM port does not exist.

V5.08.08 - 2016-April-24 Release

- BUG FIX - Site Latitude/Longitude were not always being sent to the mount when initializing through the driver.

V5.08.07 - 2016-April-06 Release

- BUG FIX - Completely reworked site Latitude/Longitude Save/Restore
- BUG FIX - ASCOM RightAscensionRate and DeclinationRate were not being enabled for GTOCP4
- BUG FIX - Show Virtual Handbox by default was not working correctly
- BUG FIX - Fixed a few minor ASCOM conformance issues
- IMPORTANT NOTE: this Build was checked and passes all ASCOM Conformance tests with no Issues or Errors.

V5.08.06 - 2016-April-02 Beta

- BUG FIX - Setting the Meridian limits in the user interface was not working.
- BUG FIX - Time synchronization was not working.

V5.08.05 - 2016-February-06 Beta

- BUG FIX - RA/DEC Bookmarks were not being displayed if no previous bookmarks were set in the AP.INI when moving settings to the new database settings storage.
- BUG FIX - In the setup window the site settings values could get out of sync with the database if values were changed but not saved. The driver now will now not allow the settings window to close until site settings have been saved or canceled.
- The driver defaults have been changed to now show the driver when an application connects.

V5.08.04 - 2016-January-18 Beta

- BUG FIX - GTOCP4 mount type was not defined properly and this ultimately caused an Error 380 in the setup window.

V5.08.03 - 2016-January-17 Beta

- BUG FIX - in the driver setup window, when entering a decimal site latitude or longitude value, if the decimal value had all zeros (e.g "28.00") the minutes and seconds fields would not get filled in. Also a carriage return was not being accepted to force the conversion from decimal to hours, minutes, and seconds.

V5.08.02 - 2015-December-29 Beta

- Installer - Changed installation location to a sub-directory under Telescope (e.g. "C:\Program Files\Common Files\ASCOM\Telescope\Astro-Physics")
- Started digitally signing the driver, each executable application, and the installer for greater security.

V5.08.01 - 2015-December-22 Beta

- Changed order of text in a few controls to Latitude/Longitude instead of Longitude/Latitude.

V5.08.00 - 2015-November-23 Beta

- **SIGNIFICANT CHANGE** -> Settings now saved to local shared (with APCC) database file (Settings.apdb) instead of AP.INI. Old settings will be automatically copied to the new database ("settings.apdb") the first time the driver runs.
- Site configuration now uses a single drop down list box for site names.
- Sites are now common between APCC and the driver.
- RA/Dec and Alt/Az Bookmarks are now saved and shared with APCC.
- Eliminated "Send Longitude/Latitude to Mount" buttons because this can cause the mount to be unexpectedly re-oriented.
- IMPROVEMENT - Added Site name to Virtual Hand box window. It will be highlighted if the site's lat/long coordinates do not match the mount's. Clicking the site name will open the driver page up to view the difference.
- BUG FIX - Longitude/Latitude can no longer be changed after the mount has been initialized. If set from the ASCOM driver the changes will take effect the next full initialization.
- BUG FIX - retical brightness was not being saved.
- BUG FIX - Some settings were saved multiple times needlessly.

V5.07.02 - 2015-October-31 Release

- BUG FIX - Safe Slewing did not operate correctly always when parking the mount.
- Added option to not show the Park 1 warning any more.

V5.07.01 - 2015-August-30 Beta

- BUG FIX - When decimal and comma are swapped because of regional settings the driver was sometimes passing improperly formatted commands to APCC.

V5.07.00 - 2015-August-08 Beta

- BUG FIX - After a slew completes set to Sidereal so driver does not set tracking rate to custom rates. This was causing the driver to send custom rates to APCC by accident.

V5.06.05 - 2015-April-25 Release

- Replaced "Allow connect when mount not present" with a timeout value in seconds. The new field is in the Advanced page of the driver's Initial Setup dialog window. A value of "0" is an infinite timeout. Values from 1-600 seconds are also accepted. When a timeout occurs during an ASCOM Client's connect attempt control is returned to the ASCOM client application. Previously, if the "Allow connect when mount not present" was enabled, control might not ever be returned to the driver if the mount is not connected.
- Added a new variable "SafeSlewRaDec" that can be used in AP.INI. The default if it is not present is that Safe Slews are enabled (SafeSlewRaDec=1). To disable safe slews set SafeSlewRaDec=0 in AP.INI.
- On connecting to the mount the driver will now query the mount type and if a fork mount only do raw RA/Dec slews (no safety slews even if "SafeSlewRaDec=0" in AP.INI).
- Updated Windows version checking (in top of log files) to properly display the Windows version through Windows 10

V5.06.04 - 2015-March-25 Release

- Added a variable to enable old button down behavior found in 5.05.16 and earlier drivers, which while being more responsive might not register button up or down events when using remote desktop-like software..

This option is off by default. Add this line to AP.INI to enable it:

```
UseOldButtonBehavior=1
```

- Improved "Allow connection when mount not present". If not enabled and the COM port not present or mount does not respond the driver will report failure to connect. If present the driver keeps trying to connect.

V5.06.03 - 2015-March-13 Release

- BUG FIX - Tracking sometimes stopped when connected in 05.06.02.
- ENHANCEMENT - ASCOM driver call to DoesRefraction call now reflects APCC's refraction enabled check box.

V5.06.02 - 2015-January-16 Release

- BUG FIX - Throw exception immediately if COM Port not available

V5.06.01 - 2014-December-30 Release

- BUG FIX - Custom RA/Dec rates was always being set after a slew completed.

V5.06.00 - 2014-October-05 Release

- Validate range of custom rate to -99.9999x to 99.9999x sidereal.
- Adjusted Park 4 location.

V5.05.41 - 2014-September-27 BETA

- Prevent use of Tracking via PulseGuide if mount has a GTOCP3 controller.
- Stop popping up unpark dialog whenever user clicks "Don't Unpark" when mount is uninitialized.

V5.05.40 - 2014-August-18 BETA

- Change behavior of AbortSlew() so that TheSkyX's jog buttons work correctly. When releasing a button SkyX calls AbortSlew() but technically a "slew" is a move to a specific RA/Dec or Alt/Az coordinates, not a move of unspecified duration as is the case when the user presses a move button in SkyX. This change will send a command to return the mount to sidereal if a slew was not in progress. The case where a slew actually is in progress is much more complicated and behavior is not (and doesn't need to be) unchanged.

V5.05.39 - 2014-August-14 BETA

- Bug Fix - when using the driver through APCC sometimes the slewing active flag was not being set quickly enough causing fast polling ASCOM applications to think the slew was done even though it had only just started.

V5.05.38 - 2014-July-20 BETA

- Added extra checking for detecting power loss and making sure initialization occurs after power is restored.

V5.05.37 - 2014-July-12 BETA

- Bug fix -- after power cycle the driver was not initializing the mount when it should.
- Added new option in the driver's advanced settings to allow MoveAxis compatibility with most ASCOM clients. That is when the option is NOT checked (the default) and an ASCOM client sets the RA MoveAxis rate to 0 tracking will be returned to sidereal rate instead of stopped. Checking the option (NOT the default) will produce the old behavior where RA MoveAxis = 0 stops RA tracking.

V5.05.36 - 2014-July-11 BETA

- Fixed mixed up flashing text when slewing.
- Made sure Latitude/Longitude are in order.
- Add item link to driver's start menu items for Release Notes Notes (this document).

V5.05.35 - 2014-July-10 BETA

- When "Allow connect if mount isn't present" is checked in the AP driver's advanced settings the driver will, when initially connecting to the mount, continually try checking for a connection at 200 msec intervals.

V5.05.34 - 2014-June-27 BETA

- Changed initial serial port receive timeout from 150ms back to value read from settings file.

V5.05.33 - 2014-June-23 BETA

- Improved robustness when driver needs to start APCC. Sometimes a second instance of APCC would start.
- Improved power-loss/restart handling of commands. Sometimes the commands were sent out of order and the mount could lose position.
- Added a new property to the driver, ReceiveTimeoutMS, that allows a client to change the read timeout.
- Fixed the max command retry count, which wasn't actually being used.
- Set initial serial timeout to 150 msec. After connection is still gets set to the value read from the settings file.

V5.05.32 - 2014-May-05 BETA

- When parked through APCC sometimes the Park request would not seem to complete.

V5.05.31 - 2014-February-03 BETA

- If Synchronization to APCC is lost, when re-established, re-query APCC for various mount information.
- "Pause logging when parked" sometimes shut off logging too soon.
- Use LST from mount instead of calculating it when firmware is Rev S or later.

V5.05.30 - 2014-January-25 BETA

- When parking the ASCOM driver sometimes returned control to an ASCOM client before parking was complete.

V5.05.29 - 2014-January-25 BETA

- When slewing through APCC the driver did not always indicate slew was active.

V5.05.28 - 2014-January-25 BETA

- Removed the command that was turning off APCC's pointing and tracking correction when parking the mount.

V5.05.27 - 2014-January-20 BETA

- To keep log file from growing automatically pause logging while parked for 3+ minutes.
- Slightly redefined Park 1, 2, and 4 Park Positions.
- Counterweight up park now handled by driver when used with APCC (requires APCC 0.99.99.54 or later)

V5.05.26 - 2014-January-9 BETA

-
- New Brightness command needs to accept a "1" response.

V5.05.25 - 2014-January-6 BETA

- Fixed Unpark 4.

V5.05.24 - 2013-December-22 BETA

- Restored the option to use Park 1 but with a warning message if you select it.
- IMPORTANT: please confirm that your park and unpark positions are still correct as this version reorganized the order of the park positions. To check, open the driver's Telescope Setup. and confirm your settings.
- Made improvements to the RAW command processing of the SetParkPosition, SetUnparkPosition. In addition to passing an index into the list to use you can specify the name of the park position(e.g,CommandString("RAW,SetParkPosition,Park 4", True)). A warning message will not pop up if Park 1 is selected in this way.

V5.05.23 - 2013-December-15 BETA

- Added new option in the Telescope Setup on the Advanced page, "Other Options" group box. This option, which is enabled by default, will force a N/S/E/W calibration immediately before the first time a slew is done whenever the driver is run. The calibration takes less than a second so it should not cause any noticeable slowdown in telescope operations.
- Added a new script command "AutoCalibrateNSEW", to allow a script or application perform the N/S/E/W calibration.
- ApJog: Added a "Calibrate N/S/E/W" button to ApJog to allow manual N/S/E/W calibration.

NOTE: the Calibrate N/S/E/W routine is not needed when using APCC. In fact, it may not reliably calculate direction because APCC caches RA/Dec values., which are critical for determining direction.

V5.05.22 - 2013-December-11 BETA

- The Swap N/S and Swap E/W buttons now will have a yellow background if Rev U or later firmware is installed and the corresponding direction is reversed. **IMPORTANT:** If RA or Dec movements are reversed via the Swap N/S or Swap E/W this will cause some autoguider calibration routines to fail, when autoguiding through the driver. Each button will show a tool tip warning message when its background is yellow.

If you are running an earlier firmware version than "U" (released December 2013) and experience runaway guiding in RA or Dec you should click the appropriate swap button (Swap N/S or Swap E/W corresponding to the problematic axis) and follow your software's Autoguider recalibration procedure. This should make autoguiding to work correctly.

V5.05.21 - 2013-December-7 BETA

- Added "Cancel" button to bookmark Alt/Az and RA/Dec goto's. Rebuilt APSetup.exe with .Net (it was built in VB6) to allow it to run as a regular user. Also added check boxes to installer to optionally install desktop icons for the utility programs installed by the driver.

V5.05.20 - 2013-November-13 BETA

- Indicate that the driver is configured to use APCC by appending "(APCC)" after the COM port in the Mount Information control frame.

V5.05.19 - 2013-November-10 BETA

- When Rev U or later is installed use new reticle brightness command instead of sending a stream of B+ and B- commands.

V5.05.18 - 2013-September-27 BETA

- Fixed Setup Wrong Slew Speeds for 1200 and 3600
- Clicking RA/Dec fields will immediately stop a slew or park instead of popping up a dialog asking the user to confirm.

V5.05.17 - 2013-September-22 BETA

- Expanded processing of version string returned from the control boxes.
- Improved internal abort slew implementation.
- When APCC is present commands for slew and park are now passed to APCC to be handled by APCC instead of the driver. This behavior can be overridden by setting ApccHandlesSlews=0 in AP.INI.
- Button presses were purposely ignored when the driver was in a timer. Changed behavior so that those button presses are no longer ignored. This affected the Park, Unpark, Set Alt/Az Park, Slew To RA, Slew To Dec, Swap N/S, and Swap E/W buttons.
- Attempted to make the move buttons operate more robustly for those with wireless mice. This safety comes at a cost of the move buttons not always being as responsive as before.
- When a button move is active the appropriate RA and Dec field on the hand box will highlight.
- Removed multiple attempts to reslew to parked position.

V5.05.16 - 2013-August-17 BETA

- IMPORTANT change for PARK and UNPARK Operations: Replaced Park 1 with Park 4, which places the scope on the East side of the mount instead of the West side. This was done because when the mount started tracking from Park 1 and the user waited too long (maybe about 10 minutes) the mount could end up with the counterweight higher than the scope. When initiated in that position the scope would dive underneath the mount if commands to slew to a visible object in the sky.

V5.05.15 - 2013-July-21 BETA

- "Admin" will appear in the ASCOM logo when the user is running "As Administrator". Admin status also gets logged in the log file.
- Added new option in the Advanced settings to auto-enable tracking when ASCOM clients send certain commands with tracking disabled (e.g. ACP, CCDAP, TheSky). A user reported that ACP in particular sometimes sends a command when tracking is disabled so enabling this option should allow ACP to function more harmoniously with the driver.

V5.05.14 - 2013-May-15 BETA

- Added Windows Process priority option to Setup (advanced section) and the virtual hand box. Default priority is set to "Above Normal".

V5.05.13 - 2013-Apr-20 BETA

- Check for latest driver version is now also done in setup dialog window.
- Added new internal commands to:
 - Allow reading/writing of AP.INI file values for automated setup of the driver by APCC.
 - Return the full path of AP.INI
 - Return a comma separated string of all values in AP.INI
 - Return the log directory and current Log File name

V5.05.12 - 2013-Mar-30 BETA

- Added new Mount Types: Ap1100GTO and AP1600GTO
- Added automatic check for updates (can be disabled in setup dialog in advanced settings).
- Added new RAW commands for compatibility with APCC Horizons

V5.05.11 - 2012-Dec-31 BETA

- For Rev >= S chips when setting meridian delay first read the current meridian delay value from the mount and only change if different.

V5.05.10 - 2012-Dec-02 BETA

- Fixed "Clear Meridian Delay" when controller revision >= "S".

V5.05.09 - 2012-Nov-26 BETA

- Fixed an issue with the Meridian delay and chips with revisions >="S" .

V5.05.08 - 2012-Oct-24 BETA

- AP RAPAS Fix for zoomed Southern hemisphere. Improved graphics.
- Fixed issue with Tracking Rate implementation for GTOCP2.

V5.05.07 - 2012-Sep-09 BETA

- Minor fixes to Right Angle Polar Alignment Scope Utility
- Pass through APCC timeouts to the driver.

V5.05.06 - 2012-Sep-03 BETA

- Unchecking "Keep Synced to PC" now should work correctly.
- Added new Right Angle Polar Alignment Scope Utility. Accessed through the menu, system tray, or a button on the ASCOM driver panel..

V5.05.05 - 2012-Aug-30 BETA

- Fixed Park 3 in Southern Hemisphere when "Convert Alt/Az to RA/Dec" is checked.
- Added PEC Record button.
- Don't allow set time to PC time within 2 minutes of midnight.
- Added new GOS state "Auto-Park enabled". An asterisk identifies when autopark is enabled and unparked (i.e., status will be: "Unparked*").

V5.05.04 - 2012-Jul-07 BETA

- Clear Slew Abort Flag whenever a new slew is issued.
- If APCC is in use disable Pointing Corrector and Tracking Rate Correction when a Park command is issued.

V5.05.03 - 2012-Jun-19 BETA

- Fixed driver exceptions that would happen if parked and user tries to GOTO a bookmark.
- Add a pop up dialog box to stop accidental movements and tracking rate changes when the mount is parked.

V5.05.02 - 2012-Apr-04 BETA

- Swapped position of Alt/Az labels for consistent ordering of read back values.

V5.05.01 - 2012-Mar-15 BETA

- Fix to the Slew East before park (but only slews East when West/above pole, East/below pole)
- Fixed flickering of CwUp at park 1 position.
- Safe Slews should now be invoked when parking if "Convert Alt/Az to RA/Dec slews" is checked
- When mount tracking is stopped Alt/Az is queried instead of calculated so that the Alt/Az doesn't appear to be changing.

February 16 2012

- v5.05.00 - Official Release. Changes:
 - Updated version to use the second number instead of third in the version (i.e v5.X.0 instead of v5.0.X). This will allow minor changes to be identified in the third number in the version.
 - Fix - Disable Smart Slew in a counterweight up position when declination changes by less than 1 degree.
 - Updated documentation so that the driver will no longer be considered a beta.
 - Miscellaneous UI changes.

January 4 2012

- v5.00.04 - Beta 30
 - Start APCC and retry connect if option to use APCC is checked and initial connection fails.

December 11 2011

- v5.00.04 - Beta 29
 - Fix bug in AP Jog Utility. Drop down list would close automatically when "Keep on top" was checked.
 - Add AP Log Zipper utility to make it easier for users to zip and send logs. Add button to UI to run

it.

- Add AP Timer utility which allows you to stop tracking or park the mount after a time period.

October 27 2011

- v5.00.04 - Beta 28

- Show COM port in Mount info, even if connect fails

October 24 2011

- v5.00.04 - Beta 27

- Don't Safe Slew to meridian in counterweight up position if declination change is less than a degree.

October 17 2011

- V5.00.04 - - BETA 26 Ray Galak

- Fixed Azimuth and Declination calculation in Bookmark slews.

October 7 2011

- V5.00.04 - 2011-Oct-07 - BETA 25 Ray Galak

- Query Pier side just before setting slew complete flag.

October 5 2011

- V5.00.04 - 2011-Oct-05 - BETA 24

- Query Pier side just before slew completed.

- V5.00.04 - 2011-Oct-05 - BETA 23

- For Rev S firmware - fixed Servo Fault and Motor Stall meanings in status command.

September 30 2011

- V5.00.04 - 2011-Sep-30 - BETA 22

- Added option to Setup dialog to leave minimized driver visible in the task bar.

September 15 2011

- V5.00.04 - 2011-Sep-15 - BETA 21
 - Added option command to AP.INI, DisableSafeSlew, if set to "1" will disable SafeSlews.

September 8 2011

- V5.00.04 - 2011-Sep-08 - BETA 20
 - Added 'Don't Unpark' as option to setup's Unpark From combo box.

September 5 2011

- V5.00.04 - 2011-Sep-05 BETA 19
 - Show COM Port number in Mount Information group box header.

August 8 2011

- V5.00.04 - 2011-Aug 8 - BETA 18
 - Added two new internal commands to support APCC's Point Mapper (disable APCC horizon/slew limits and disable driver safety slews).

July 17 2011

- V5.00.04 - 2011-Jul-17 - BETA 17
 - New Feature: Added Bookmarks for RA/Dec and Alt/Az coordinates.

July 13 2011

- V5.00.04 - 2011-Jul-13 - BETA 16
 - Fixed bug in Alt/Az conversion. Added Alt/Az conversion for all Park positions.

July 5 2011

- V5.00.04 - 2011-Jul-05 - BETA 15
 - Fixed a bug in the Unpark logic that would affect mounts powered on after parking.

June 25 2011

- V5.00.04 - 2011-Jun-25 - BETA 14
 - Made changes to pass ASCOM Platform 6 Conformance testing
 - Added MoveAxis ASCOM commands
 - Various refinements for APCC.

April 24 2011

- V5.00.04 - 2011-Apr-24 - BETA 13
 - Fixed another possible bug in counterweight-up slew.
 - Fixed: after parking the mount it would unpark itself when exiting TheSkyX. This seems to have been caused by an AbortSlew command being issued by TheSkyX. The AbortSlew Sends a "Q" command to the mount which unparks it.

April 15 2011

- V5.00.04 - 2011-Apr-15 - BETA 12
 - Fixed possible bug in counterweight-up slew.

April 10 2011

- V5.00.04 - 2011-Apr-10 - BETA 11
 - Added Safe Slew capability that should prevent a slew from causing a collision when starting a slew with the counterweight up.
 - Local Sidereal time is now calculated within the driver.
 - Alt/Az is now calculated within the driver.
 - Added APJog, a utility to jog (slew) the scope by an exact distance.

March 14 2011

- V5.00.04 - 2011-Mar-14 - BETA 10
 - Bug Fix: ASCOM Sync command works again.
 - Refined/streamlined the unpark command sequence

February 20 2011

- V5.00.04 - 2011-Feb-20 - BETA 9
 - New Feature: Allow user to select a "Counterweights-up" park position
 - Fixed an unpark scenario where tracking would not start.
 - Fixed a problem with Custom RA/Dec Rates not being correctly applied.
 - New Feature: Added a Text label, yellow in color, which says: "CwUP", next to the East/West pier

side. The label shows when the counterweights are higher than the scope. NOTE: there are some conditions when slewing when the indicator will not be accurate until after the slew completes.

- Added confirmation dialog when user clicks "Set Alt/azPark Location". A warning is given if the counterweights are in an "UP" position.
- Fixed possible cause of Overflow "Error 6" messages that have been reported occasionally.
- Fixed detection of the Sidereal tracking rate (i.e. enabled/disabled) when driver starts.

January 19 2011

- V5.00.04 - BETA 1-8
 - Possible fix: Slew to Alt/Az Park sometimes didn't work.
 - BUG FIX - when unparking the mount when tracking=enabled the mount's tracking was always stopped.
 - BUG FIX - SG command format for non-integer Time Zones
 - BUG FIX - Altitude used for Southern Hemisphere Park 3/Unpark 3 operations.
 - Use extra, extra long timeout (5000 msec) when used through APCC's virtual port.
 - Enhancement - Added checkbox in setup dialog to query if connection is to an APCC virtual port. Commands are framed for extra reliability and extra long timeout (2000 msec) is used.

August 15 2010

- v5.00.03 - Released with V5.00.03 of the driver. Changes:
 - BUG FIX - Fixed yellow bar over Lunar and Solar rate buttons.
 - BUG FIX - Fixed "Type Mismatch" error that can happen if a response string is not returned from the "MS" command.
 - BUG FIX - Unparking was not enabling tracking even if the option to "enable tracking on unpark" was checked.

July 31 2010

- v5.00.02 - Released with V5.00.02 of the driver. Changes:
 - BUG FIX - Reticle Brightness was not working.
 - BUG FIX - Setup dialog could crash if a large value was entered into one of the Site longitude/latitude fields
 - BUG FIX - Improved timing precision of focuser commands via button presses and the ASCOM interface.
 - BUG FIX - Fixed false "slew complete" for mounts with Rev S beta firmware.
 - Enhancement: Decimal values for Site Longitude/Latitude can now be entered (see documentation for details).
 - Added RCAL/Sync warning messages. User will be warned under various conditions if "Convert SYNCs to RCAL" is not checked.
 - Removed "Init Now" button. This button was used primarily for testing.
 - The popup status window can now be disabled or enabled to come up only when the driver's handbox is hidden. The default is the same behavior as before (always pop up when the mouse is hovered over the system tray icon).

- The log window can now be forced to remain hidden even though logging is on.
- Greatly improved "tab order" for controls in all windows.

July 10 2010

- v5.00.01 - Rev C. Fixed clipped text on page 21 in PDF output.

July 9 2010

- v5.00.01 - Rev B. Added a page for Client Configuration.

July 3 2010

- v5.00.01 - Rev A. Added suggestions from Howard.

June 28 2010

- v5.00.01 - reflects most of the changes in the 5.00.01 release of the driver.
 - BUG FIX - Correct problem with negative time zones (Europe).
 - If AP.INI does not exist in new directory but exists in old (beta) directory then automatically copy it to the new location.
 - Added tiny Help buttons on each group box in the handbox and telescope and focuser setup windows.
 - Always send "#:U#" when first starting
 - Only write Time Zone if it has changed to preserve non-volatile ram lifespan.

June 10 2010

- Initial Public Release of the driver (v5.00.00)
- Hardened the validation of polled commands including RA, Dec, Alt, Az, Time, Time Zone, and LST.
- Unpark will always start tracking if the UI option is checked (reported by Drew S.)

June 4 2010

- v5.00.00 - Rev B.

June 2 2010

- v5.00.00 - Rev A.

June 1 2010

- v5.00.00 - Initial release for review.

1.2 What's New

The new driver is 100% designed/built/supported by Astro-Physics.

Here are some of the new features of the Astro-Physics V2 ASCOM driver:

For V5.40.xx:

- Support for King Rate.
- Minor bug fixes.

For V5.30.xx:

- Support for Mach 2 and GTOCP5.

For V5.21.xx:

- Asynchronous Park option.

For V5.20.xx:

- Can connect to the GTOCP4 via Ethernet or Wifi.
- Screen position can be saved and restored.
- Can disable Handbox window from always being "top most".

For V5.10.xx:

- Improved robustness interfacing with APCC v1.6 (and later).
- Improved performance of mouse button presses
- Reduced disk write overhead of log files
- Increased precision of RA commands to 2 decimal places, and Dec Commands to 1 decimal place, when used with GTOCP4 and firmware P01-04 and later firmware.
- When used with the GTOCP4, ASCOM PulseGuide moves up to 99.999 seconds are accepted.

For V5.09.xx:

- Improved robustness interfacing with APCC v1.5 (and later).
- Important bug fixes improving reliability of the driver.

- User interface improvements

For V5.08.xx:

- Moved settings from a flat text file (AP.INI) to a SQLite database for greater reliability and to add new support features.
- Added a new site location field to the driver's handbox window.
- Important bug fixes
- Digitally signed executables (by *Sirius Imaging LLC*)

For V5.07.xx:

- Added option to not show Park 1 warning.
- Fixed a couple issues that showed up in use with APCC.

For V5.06.xx:

- ASCOM *DoesRefraction* property reflects the refraction setting in APCC.
- Custom move rate set to -99.9999x to 99.9999x sidereal
- Improved driver connect options to be able to handle a wider range of operation scenarios.

For V5.05.xx:

- Added PEC Record button
- Added Right Angle Polar Alignment utility.
- Added new mount types (1100/1600 GTO)
- Support for APCC Horizons program.
- "Admin" appears in ASCOM logo if running "As administrator".
- Added Park 4
- Added more robustness to handbox move buttons.
- Clicking RA/Dec fields stops a park or slew.

- Added indicators in N/S or E/W directions are reversed. When reversed runaway autoguiding can occur.
- Added automatic N/S/W/E calibration to prevent possible autoguider runaway.
- Miscellaneous user interface changes.

Since V5.05.00:

- 100% compliant with ASCOM Platform 6
- Improved robustness and logging capabilities
- Improved operation and many bug fixes (see version history [\[6\]](#) for details)
- Complete support for APCC and Rev. S firmware.
- New visual cues, like **CwUp** (Counterweight up)
- Bookmarks for right ascension and declination targets. Bookmarks for common altitude and azimuth targets.
- APJog [\[135\]](#), a standalone application to "nudge" (slew) the mount by a specific distance.
- APLogZipper [\[137\]](#), a standalone application to zip log files to mail for support issues.
- APTimer [\[136\]](#), a standalone application that, after a configurable time, stops tracking or park the mount
- Many other tiny improvements!

Improvements of the AP V2 driver over the old AP driver:

- Adheres to the ASCOM Telescope V2 Standard (the old driver only complied with the V1 standard).
- Has a hand box window which provides comprehensive status and control over mount operations.
- The driver is a telescope "hub", This means that multiple ASCOM client applications can connect simultaneously. The old driver only allowed a single client application thus requiring the use of the POTH driver. The new driver does not require POTH.
- Provides robust communications with the mount, retrying commands if it detects a communications error or corruption in a response message.
- Saves multiple observing/imaging site coordinates.

- Can be configured to convert SYNC commands to RCAL commands to prevent possible mount mis-positioning (default).
- Caches common commands that client applications query (RA/Dec/Alt/Az/Pier Side/Sidereal Time/Time) so serial port traffic does not become excessive when many clients are connected simultaneously.
- Provides a Meridian delay feature like PulseGuide and the Astro-Physics keypad have.
- Provides custom RA/Dec tracking rates for both GTOCP2 and GTOCP3 mounts.
- Monitors and reports communications errors.
- Provides asynchronous PulseGuide support. This allows autoguider moves to be made to both RA and Dec simultaneously.
- Provides control over reticle brightness.
- Provides a handy icon in the system tray that provides quick access to status and certain commands.
- Adds custom tracking rates for GTOCP2 mounts.
- Incorporates comprehensive logging.
- Provides a focuser driver for DC synchronous focus motors operated through the GTOCPx Control Box.

1.3 System Requirements

Software

1. A computer running in Windows 7 or later Windows operating system (32-bit or 64-bit).
2. ASCOM Platform 6.3 (or later) must be installed. ASCOM Platform 6.4 or later is recommended.
3. .Net Framework 3.5 and 4.x must BOTH be installed (a requirement of the ASCOM platform).
4. Rev B or later of the mount controller firmware is required. Rev D and later is required for Pier Side command (driver emulation in Rev B and C of firmware).

Hardware

1. One of the following:

- Astro-Physics GTO mount with GTOCP2, GTOCP3, GTOCP4, or GTOCP5 controller.
 - A third party mount controlled via an Astro-Physics GTOCP2, GTOCP3, or GTOCP4 controller.
 - For operation with APCC: GTOCP3 with version "V" or later, or GTOCP4 or GTOCP5.
2. A computer with a serial port or (USB/Ethernet-to-serial port converter).
 3. For serial port communication: A straight-through DB9 Male-Female Serial cable to connect a PC to the telescope.
 4. For USB communication: A GTOCP4/5 controller and standard USB 2.0 cable (15 ft or less recommended).
 5. For Ethernet communication: An Ethernet hub and ethernet cables from the hub to the GTOCP4/5 and the computer.
 6. For WiFi: computer must have a wifi card or be connected to a wifi router via ethernet cable, etc.

1.4 Installing

Before installing the Astro-Physics V2 telescope driver please make sure you have installed the ASCOM 6.0 (or later) platform. You can download it from <https://www.ascom-standards.org>. You may also need to install the Microsoft .Net Framework 3.5 and 4.x, and possibly service packs. More details on the requirements can be found on the ASCOM-Standards site.

You can always install any version of the V2 driver without uninstalling the previously installed version of the V2 driver. Note also the the V2 driver is independent of the V1 driver. Both can coexist with the V1 driver (that is both can be installed simultaneously. However both cannot be used simultaneously with the same telescope).

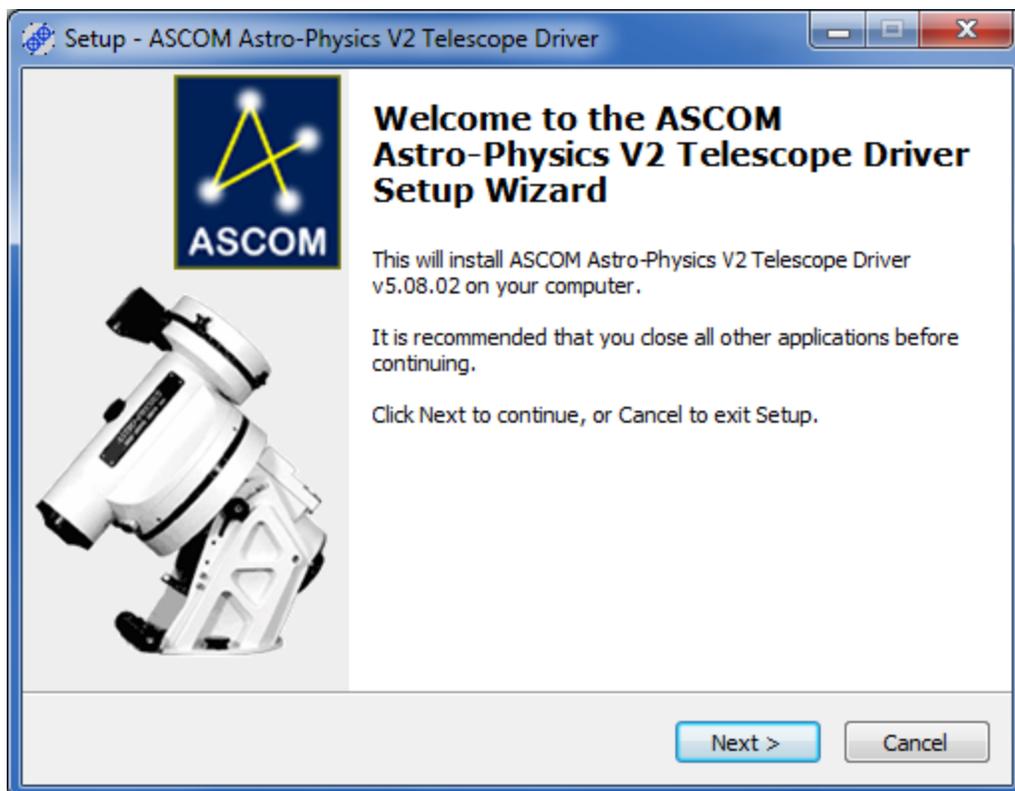
If you are updating from a beta version of the driver (v4.99.58 or earlier) you should know that the driver's work directory has changed.

On XP the new directory is (assuming C: is the Windows boot drive):

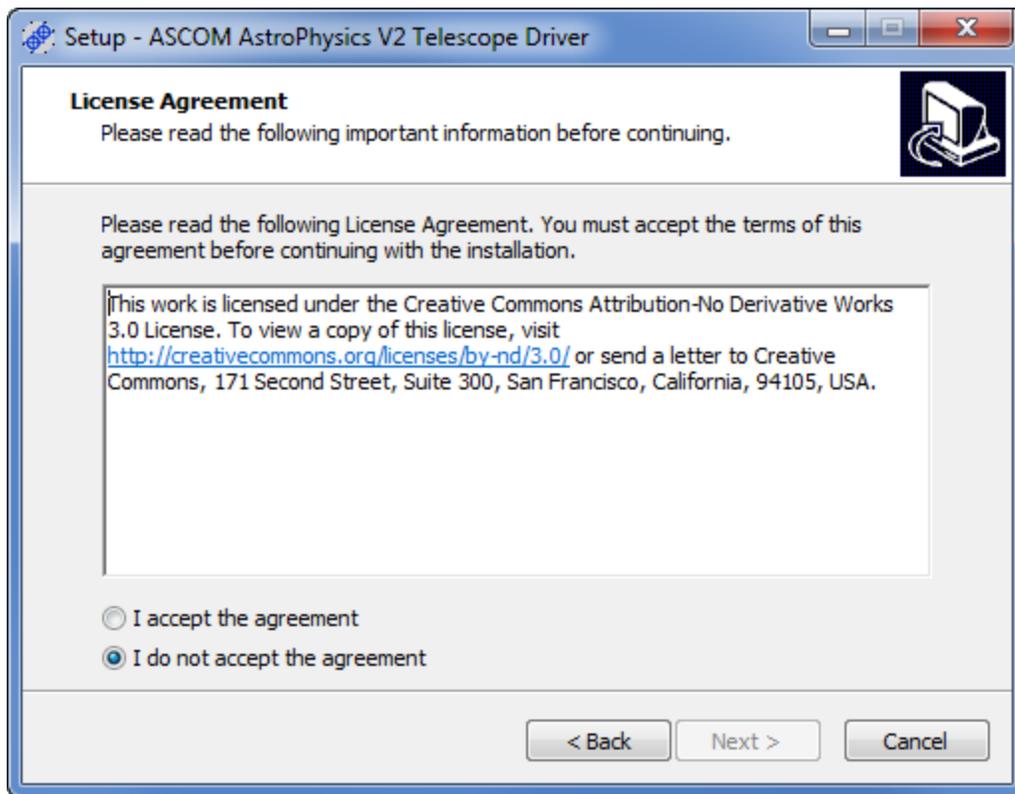
C:\Documents and Settings\All Users\Application Data\Astro-Physics\ASCOM

On Vista or later windows operating system it is here:

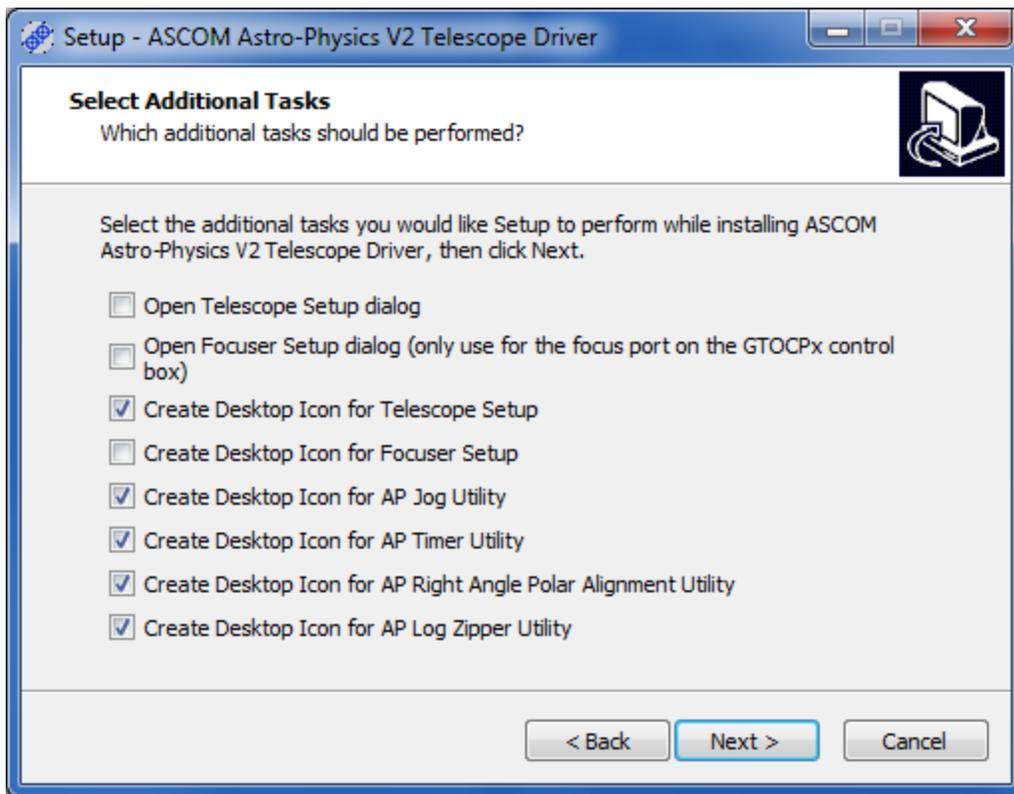
C:\ProgramData\Astro-Physics\ASCOM



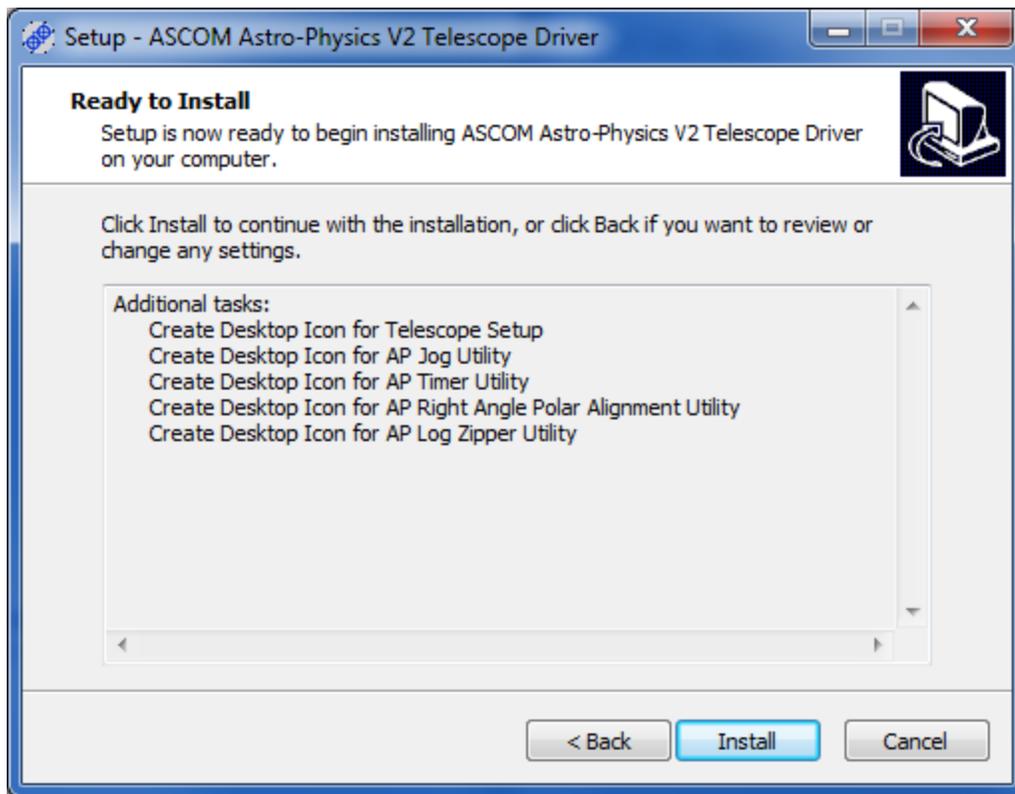
Confirm the version of the driver is as expected; then click **Next >**.



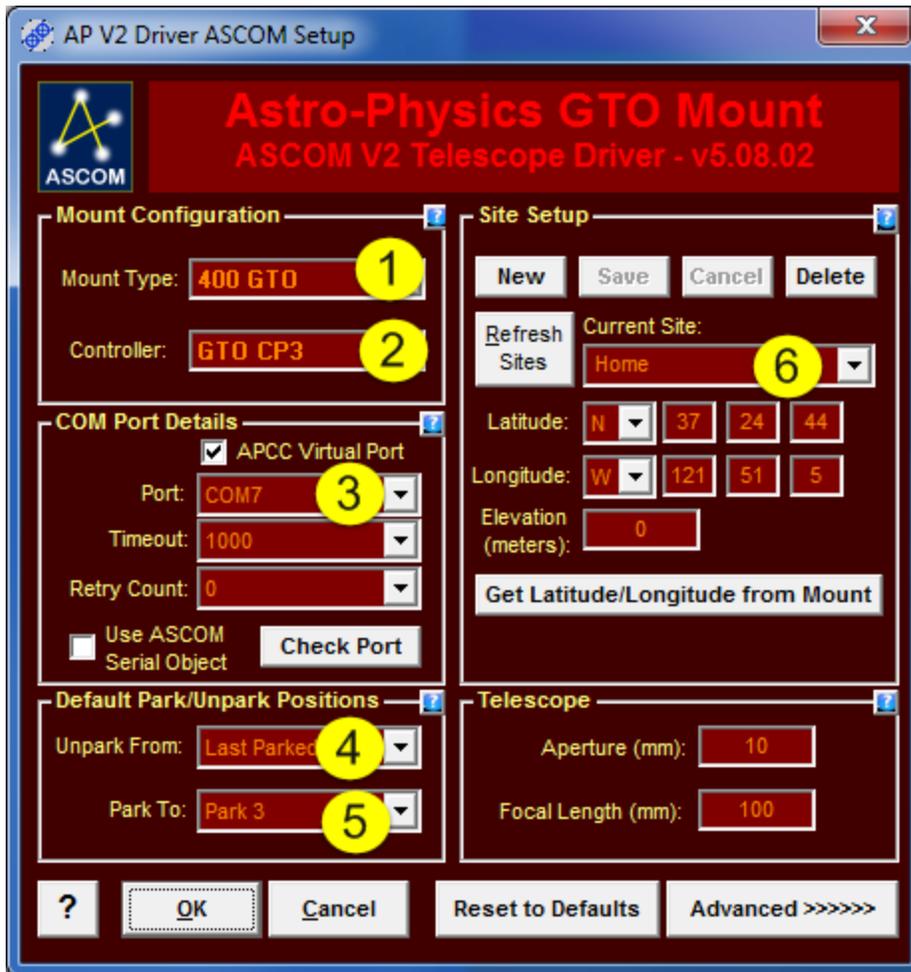
Please be sure to read the license agreement and accept it if you agree to it. Click **Next >**



If you haven't already configured the ASCOM driver (from an earlier version of the V2 driver), then check the option to **Open telescope setup dialog**. If you also want to set up the focuser driver then check **Open focuser setup dialog**. Please note that settings from the older V1 driver will not be imported into the V2 driver. Click **Next** to continue.



Click **Install** to install the driver. If you selected to open the telescope setup dialog you will now see it:

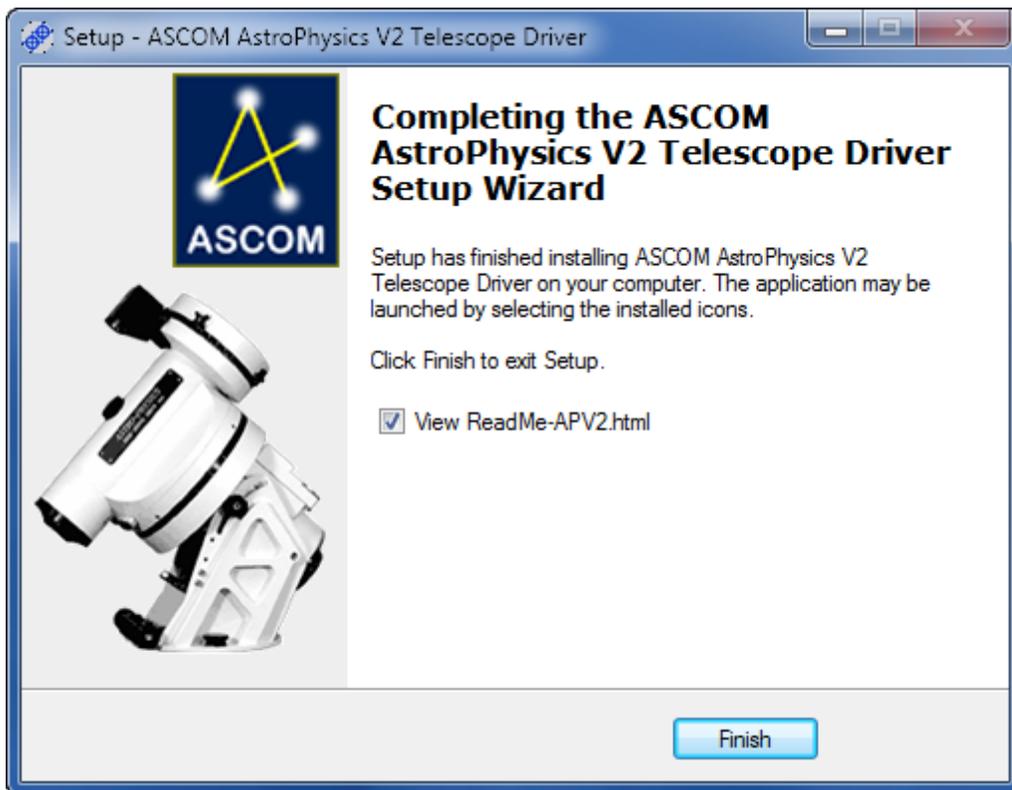


The minimum setup includes:

1. Mount Type
2. Controller. All mounts made within the last few years have the GTOCP3, GTOCP4 or GTOCP5 controller.
3. COM Port. If you have your PC connected click "Check Port" to make sure you have the correct port selected.
4. It is recommended that you configure **Unpark From** to "Last Parked"
5. Select your desired park position
6. Site location... see this section for more details ⁶⁵.

More details can be found in this section ⁷¹

Click **OK** to continue.

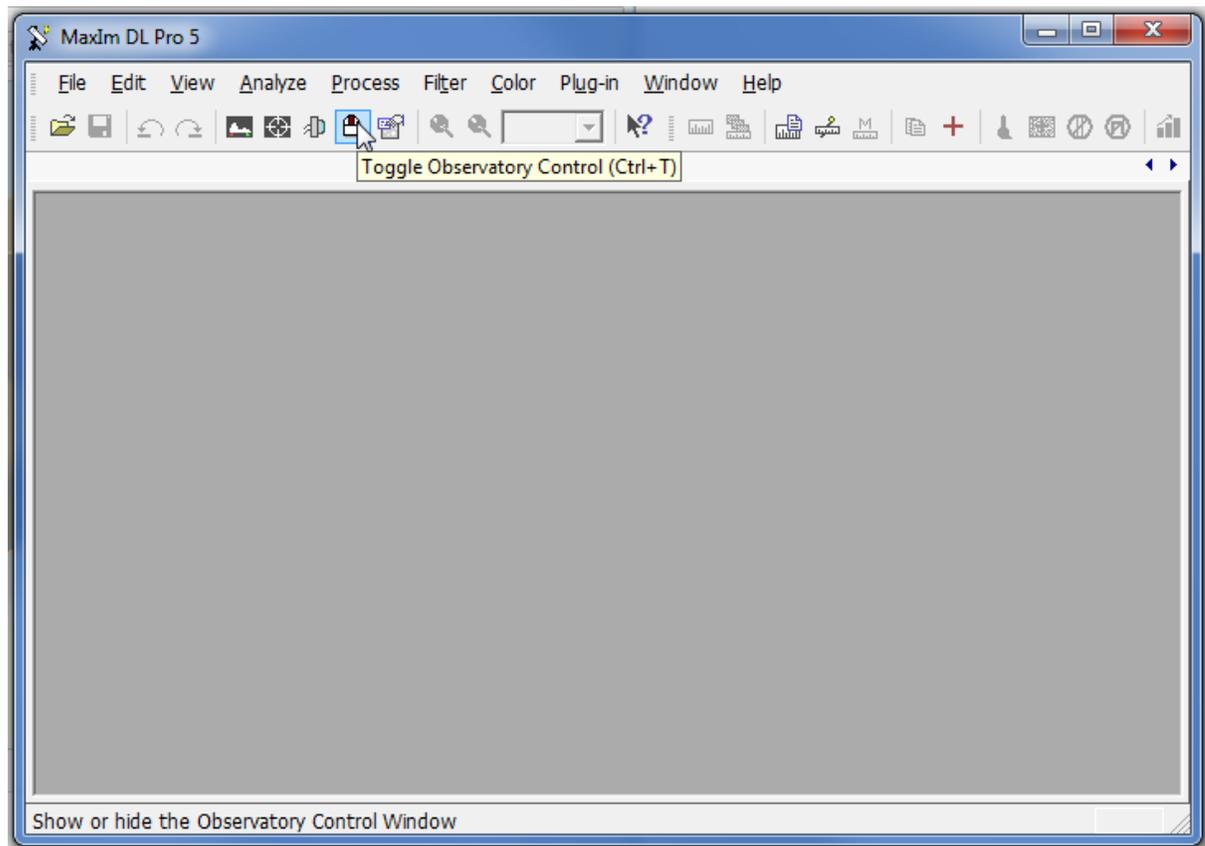


Click **Finish** to exit the installer. The driver is ready to be used!

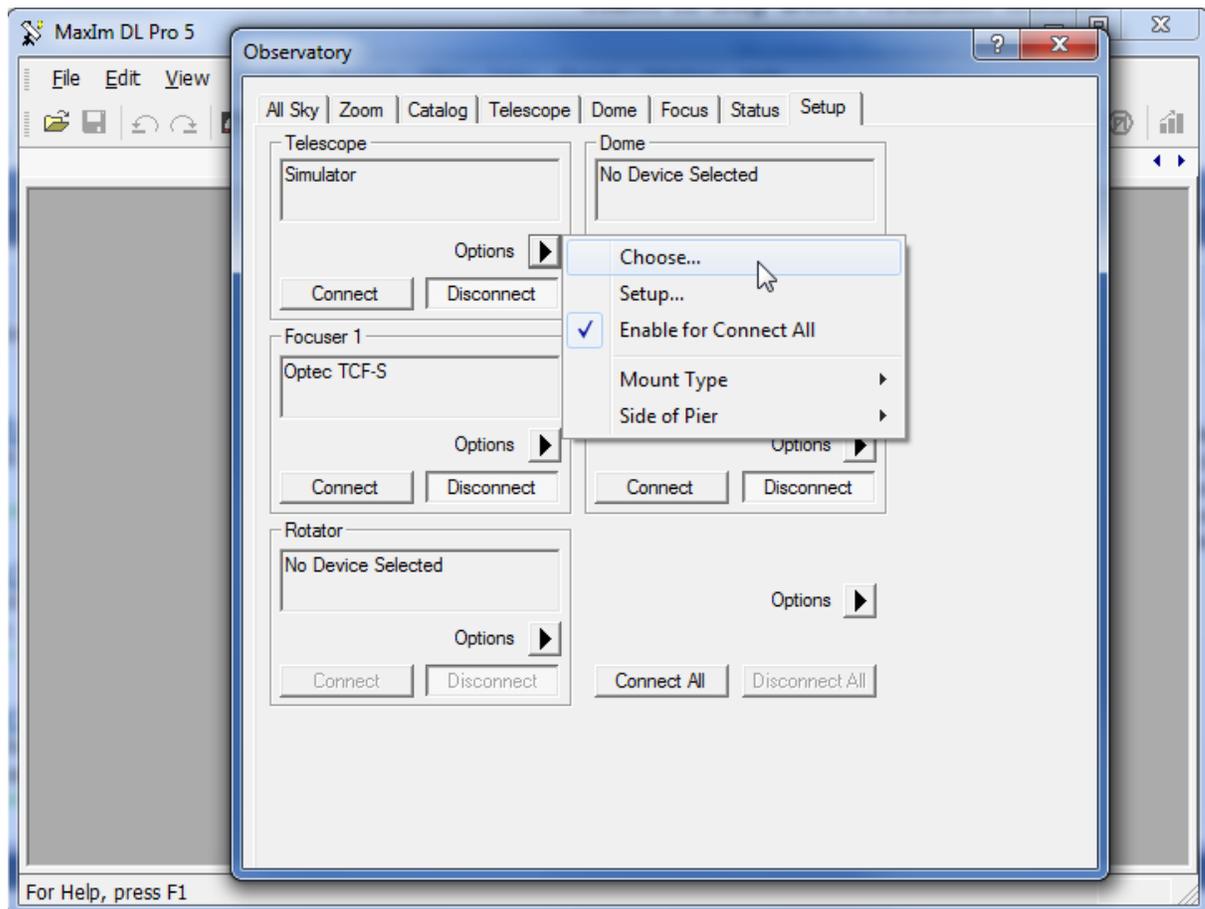
1.5 Using the Driver in a Client Application

To use the driver you need to select it in an ASCOM application.

Below is an example using MaximDL V5. Press Ctrl+T or click the Observatory Control icon shown below



When the Observatory control window opens click the **Options** button in the Telescope group box. Then click "**Choose...**" as shown below:

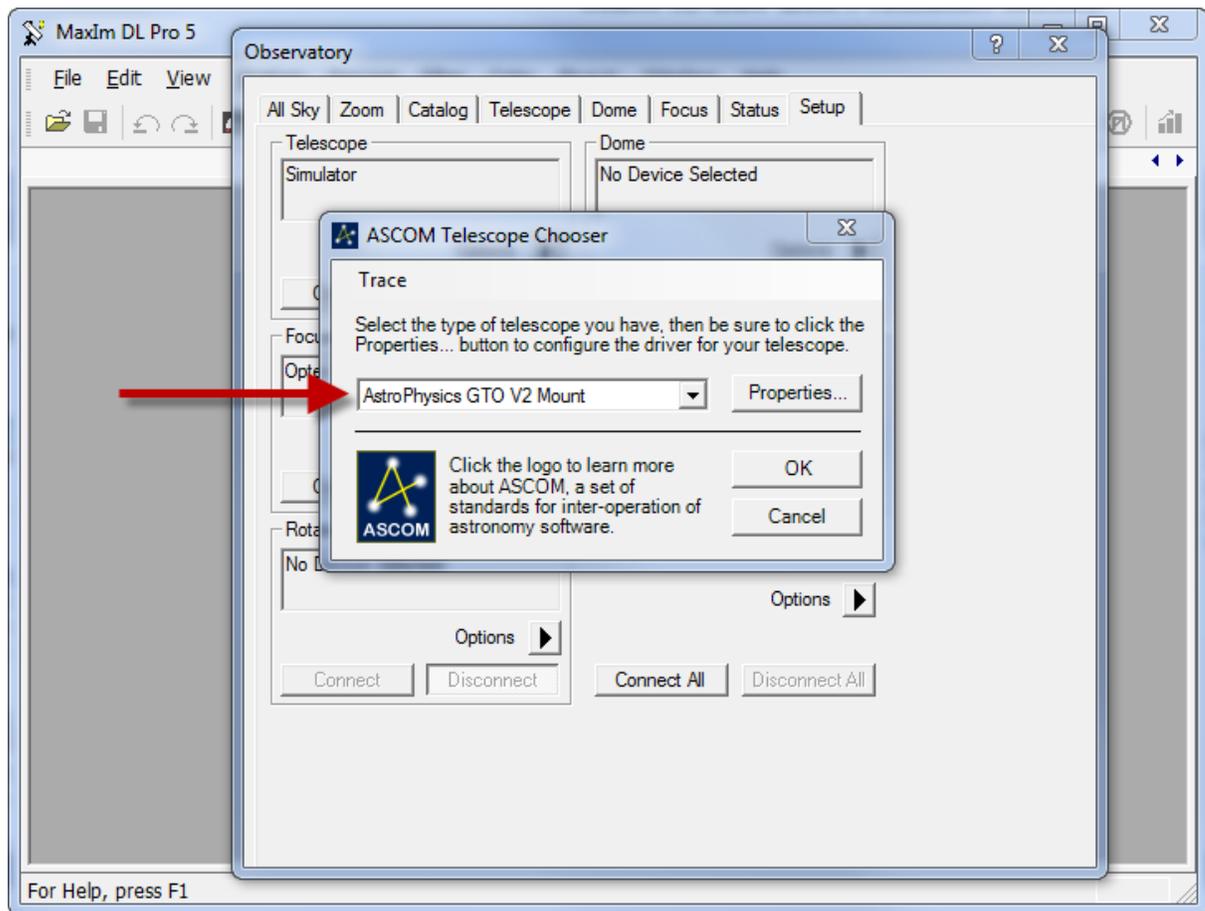


When the ASCOM Telescope Chooser displays select "**AstroPhysics GTO V2 Mount**". You may need to click the **Properties** button which will take you to the Telescope Setup ⁵⁵ dialog.

IMPORTANT: In the ASCOM Telescope Chooser make sure to select the new driver and not the old driver.

The old driver's name is **Astro-Physics GTO Mount** (note there is no "V2" in the name).

The new driver is **AstroPhysics GTO V2 Mount**. This is the item you must select.



After you are done click **OK**. The application is ready to use the ASCOM driver.

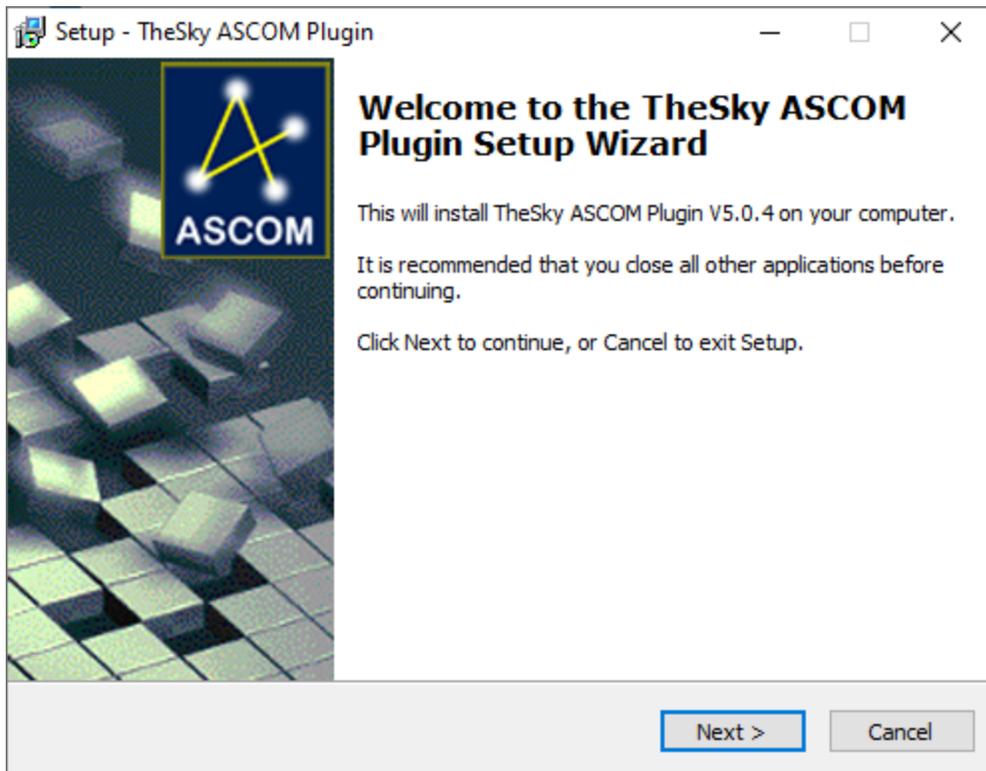
1.6 Using the driver with TheSky6 by Software Bisque

First, to enable TheSky 6's external control features:

1. Start *TheSky 6 Professional*.
2. In *TheSky's* Telescope menu, select Server Settings...
3. In the Server Settings window, Remote client capabilities section, turn on all of the options ("allow" checkboxes).
4. Also turn on Remote clients use Orchestrator's "ImageThenSlewTo" command.
5. Click OK to close the Server Settings window.
6. Now try connecting from your ASCOM astronomy program again. It should work.
7. In order to use ASCOM drivers for telescope control from within TheSky 6 you will need to install the ASCOM "TeleAPI" plug-in from here: Download TheSky TeleAPI plugin.

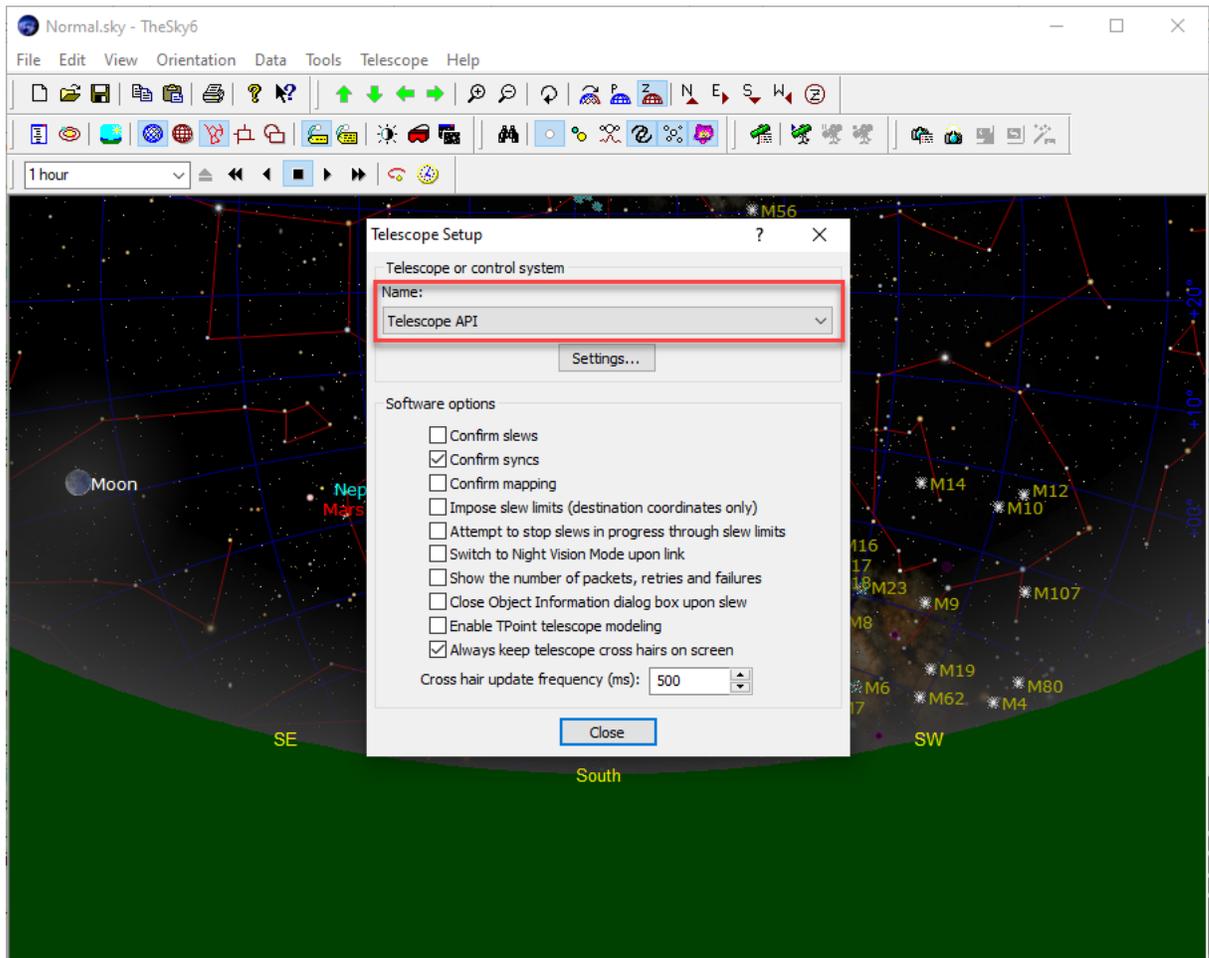
The screenshot shows a web browser window displaying the 'Plug-Ins' page on the ASCOM Standards website. The page features a navigation menu on the left with categories like 'Driver Downloads', 'Plug-In Downloads', 'Additional Downloads', and 'Developer Downloads'. The main content area is titled 'UNIVERSAL STANDARDS FOR ASTRONOMY' and lists several plug-ins. A red arrow points to the 'Download' button for the 'TheSky™ ASCOM Telescope (TeleAPI) Plug-In for TheSky 5/6 (5.0.4)'. The text for this plug-in reads: 'Do not use this with TheSky X. Plug-in that allows Software Bisque's TheSky 6/5 Astronomy Software to control telescopes via ASCOM telescope drivers. Download then run this to install the plugin. Use at your own risk, we do not support TheSky 6.'

8. Install TeleAPI(5.0.4)Setup.exe:

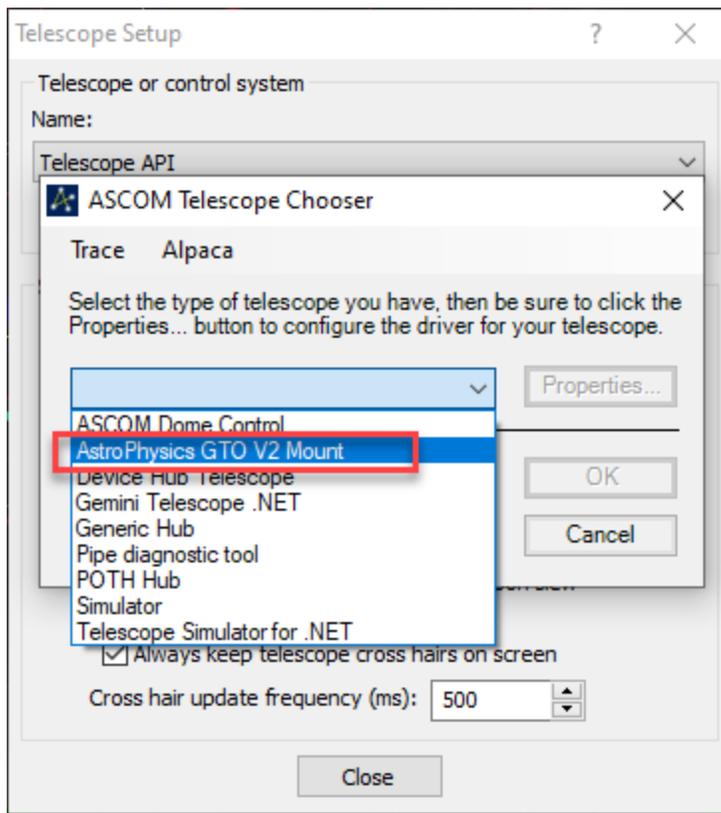


After installing TeleAPI:

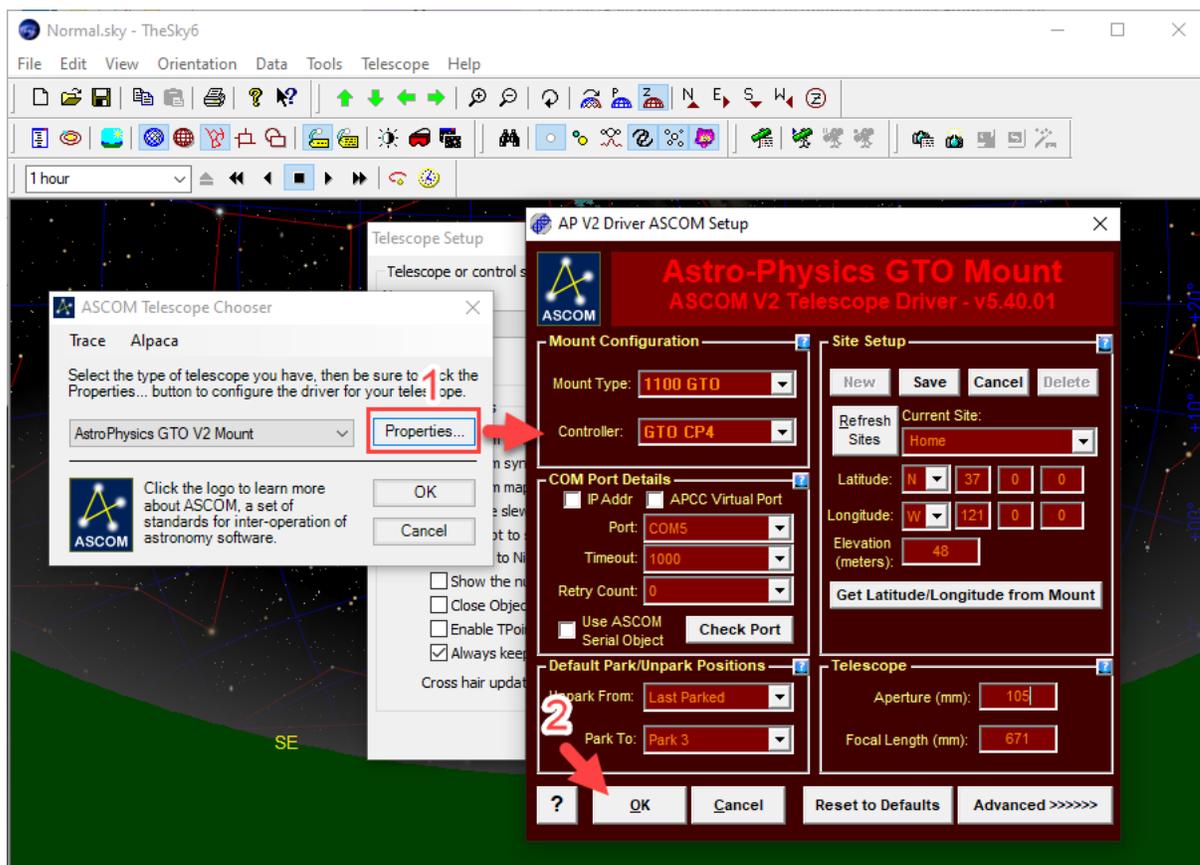
1. Start *TheSky 6*
2. In the Telescope menu, select Setup... TheSky's Telescope Setup window will appear.
3. Set the Telescope or control system name to Telescope API.



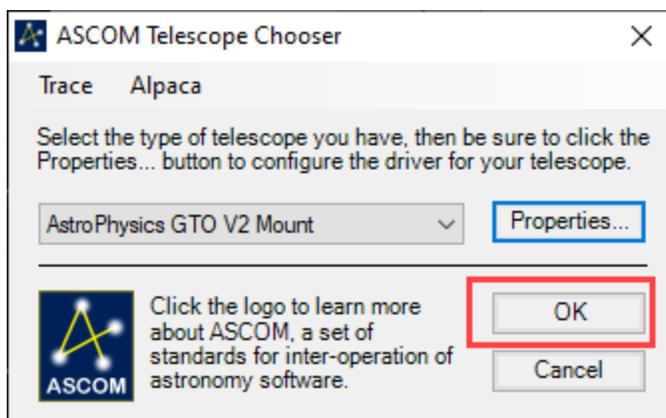
4. Click Settings... to display the ASCOM Telescope Chooser
5. Select **AstroPhysics GTO V2 Mount** telescope type in the Chooser.



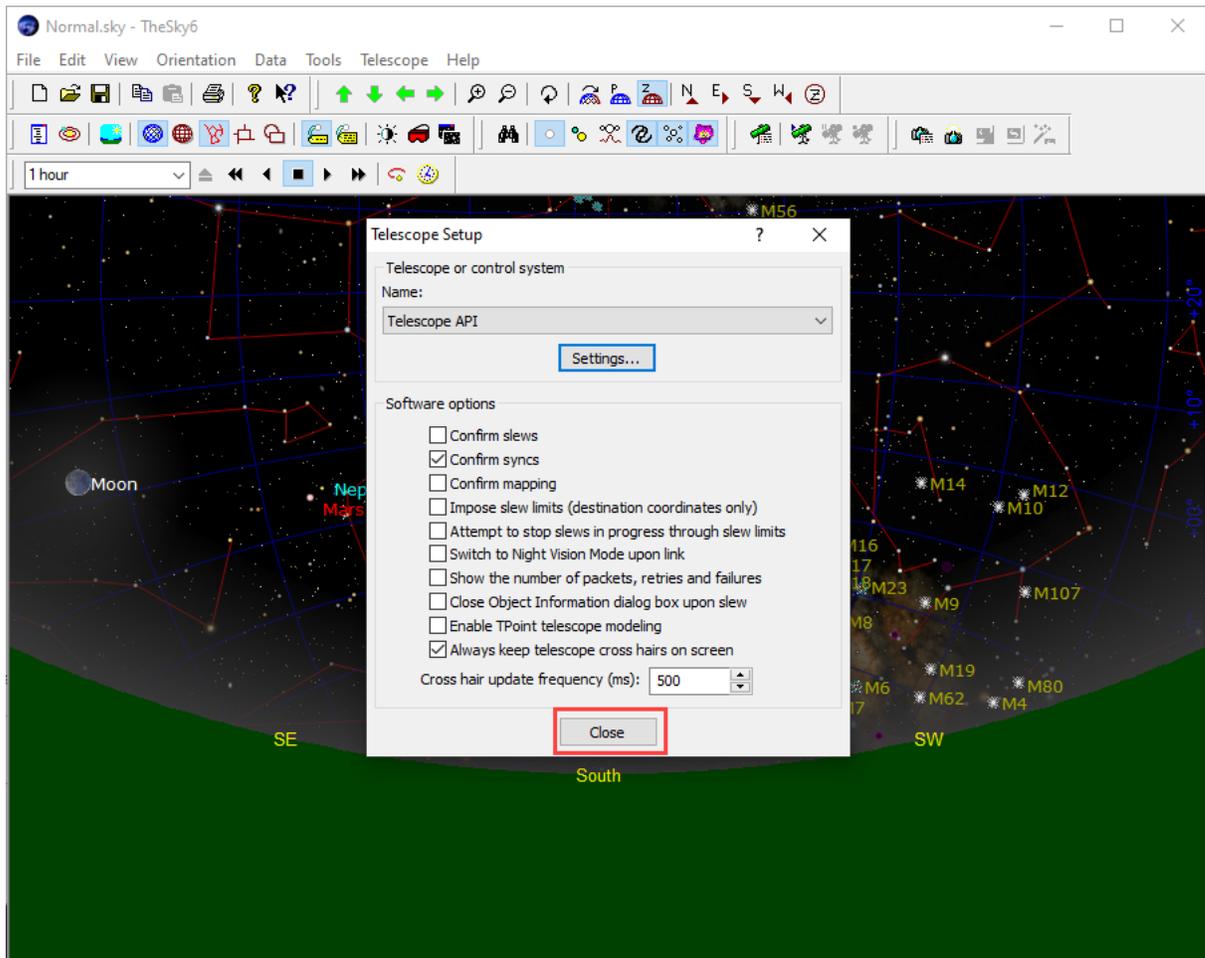
6. Now click Properties... in the Chooser. Verify the driver settings look okay, changing the settings as needed. Click **OK** in the driver setup dialog to close.



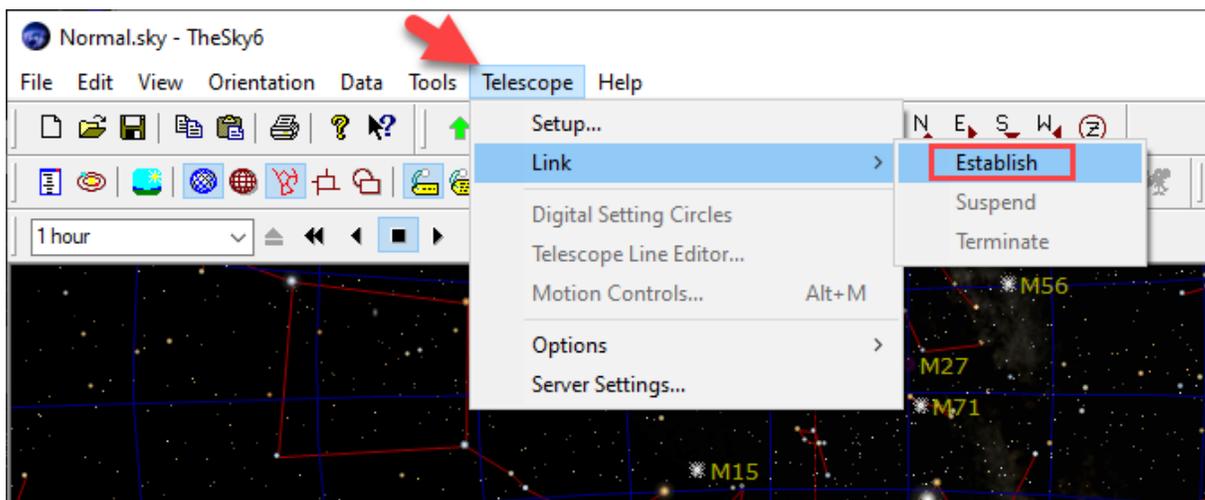
- Click OK in the Chooser.



- Click Close in Telescope Setup.



9. Now, in **TheSky's** Telescope menu, select Link/Establish. You should see the crosshairs indicating your telescope's current position, and you now have telescope control in **TheSky**.



You need to do steps 2-9 only one time.

1.7 Using the driver with TheSkyX by Software Bisque

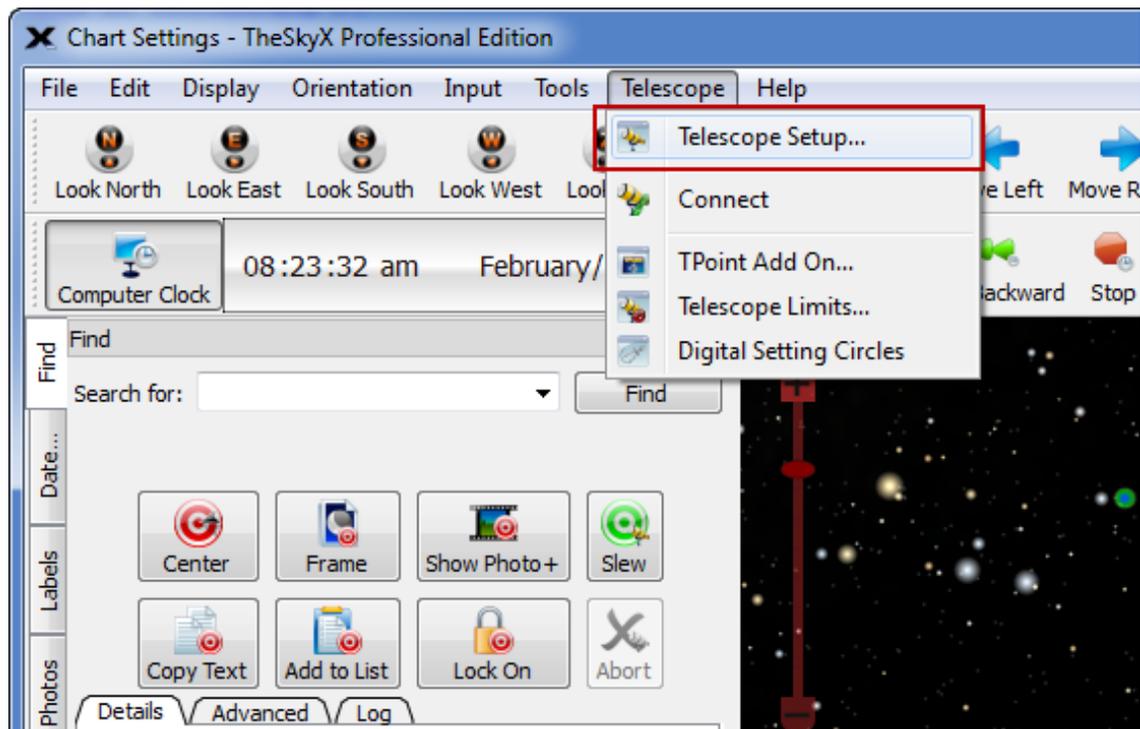
Install the ASCOM X2 Plugin

To use TheSkyX with the ASCOM driver you must first instal the ASCOM Mount/Telescope X2 plugin:

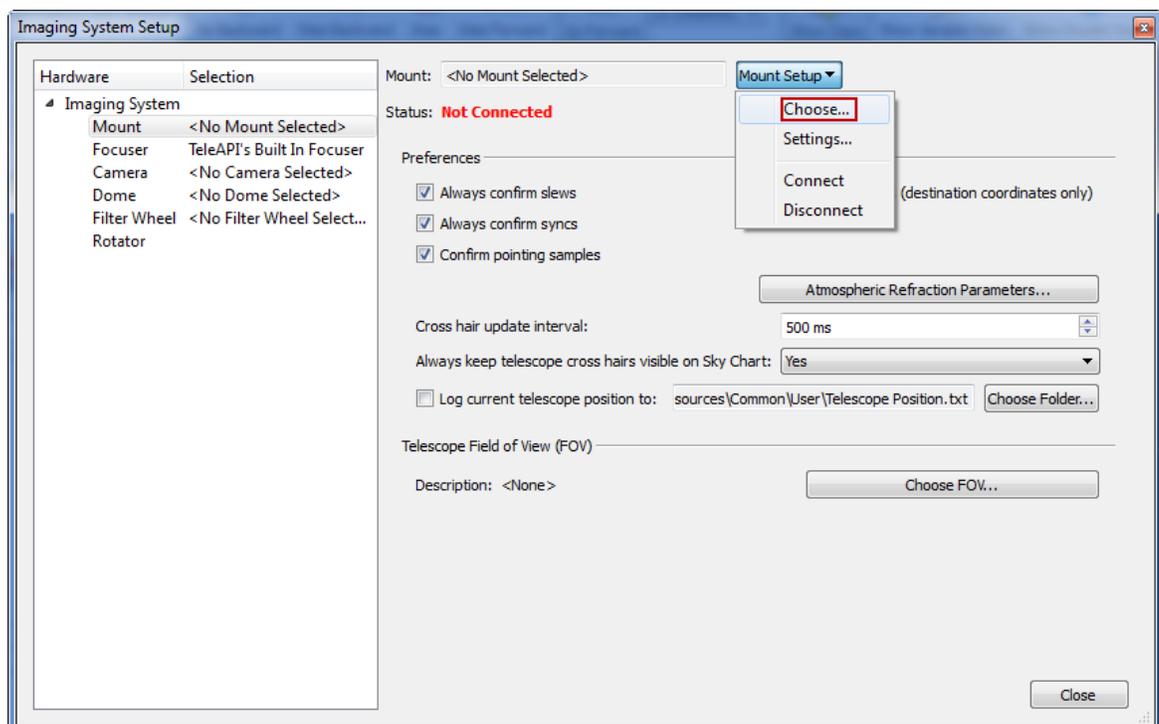
1. Bring up a browser and navigate to <http://www.ascom-standards.org/Downloads/Plugins.htm>
2. Download and install the latest version of **Mount/Telescope X2 to ASCOM Converter for TheSky X**

All that's needed is to activate TheSky X scripting support, normally only required on Windows Vista or later :

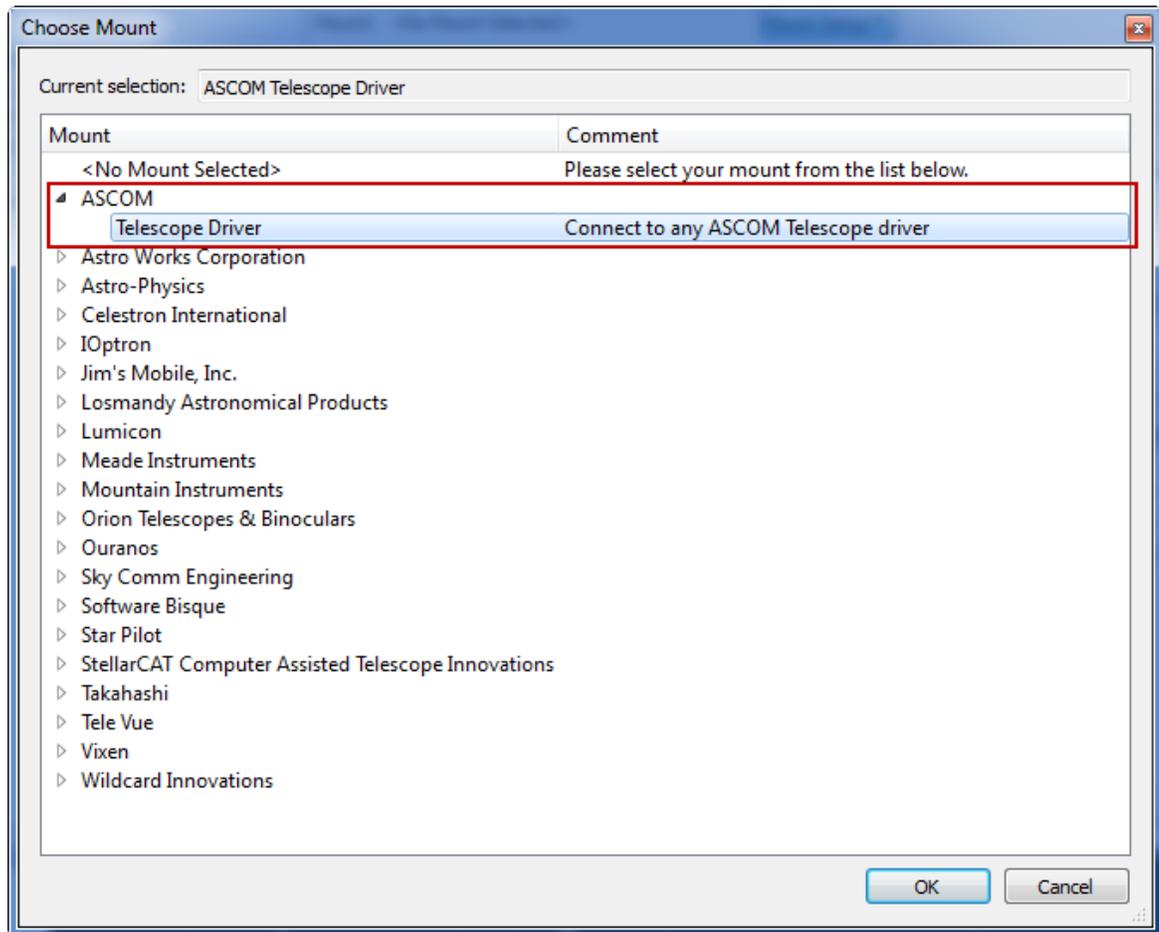
1. Locate TheSkyX executable. This is (normally in Program Files or Program Files (x86), Software Bisque, *TheSky X Professional*).
2. Right click and select **"Run as Administrator"**
3. Answer Yes to the "are you sure" security popup
4. Wait until *TheSky X* starts up completely
5. Click **Telescope Setup** in the menu:



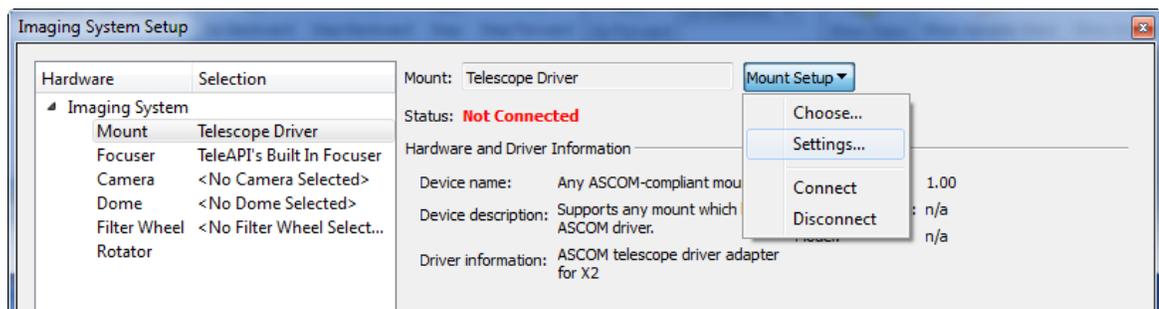
6. Click **Mount Setup** then **Choose...**



7. Select **ASCOM/Telescope Driver** for the mount type, then click **OK**.

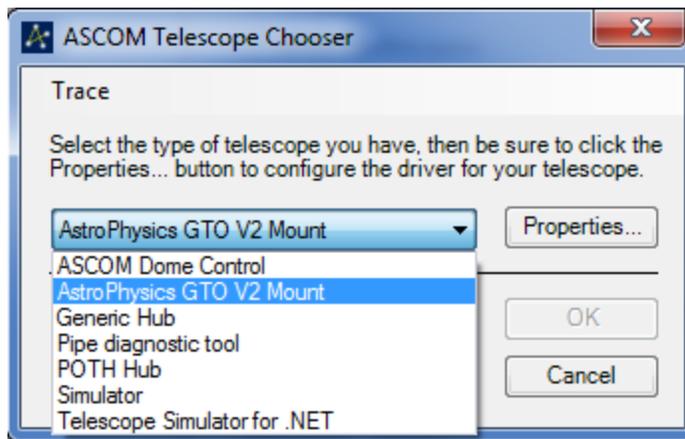


8. Now, back in the **Imaging System Setup** click **Mount Setup, Settings...** Answer No to the "Do you want to read...?" popup.



9. You will see the usual ASCOM Chooser

10. Select telescope type (**AstroPhysics GTO V2 Mount**).



11. Click Properties in the Chooser to configure the mount.
12. Close the Chooser.
13. From there it's normal *TheSky X* operation

1.8 Reporting Driver Problems

In order of preference potential driver problems can be reported via several methods:

1. Posting a message to the Yahoo Groups forum for Astro-Physics GTO mounts: <https://ap-gto.groups.io/g/main>
2. E-mail to support@astro-physics.com.
3. Calling AstroPhysics at **815-282-1513**

IMPORTANT: When reporting a potential ASCOM driver bug here are some general guidelines:

1. The first aim of a bug report is to let us see the failure with our own eyes. Please give us detailed instructions so that we can make it fail for ourselves.
2. The second aim of a bug report is to describe what went wrong. Describe **everything** in detail. State what you saw, and also state what you expected to see. Write down the error messages, especially if they have numbers in them. Better yet, **take a screenshot!**

3. By all means try to diagnose the fault yourself if you think you can, but if you do, you should still report the symptoms as well.
4. Be ready to provide extra information if we need it. The driver comes with a log zipper utility  which will package up all files usually needed to help identify the problem.
5. If other programs are involved state the EXACT version number of each program. Usually you can find this information in the programs Help->About menu item.
6. Write clearly. Say what you mean, and make sure it can't be misinterpreted!

1.9 FAQ

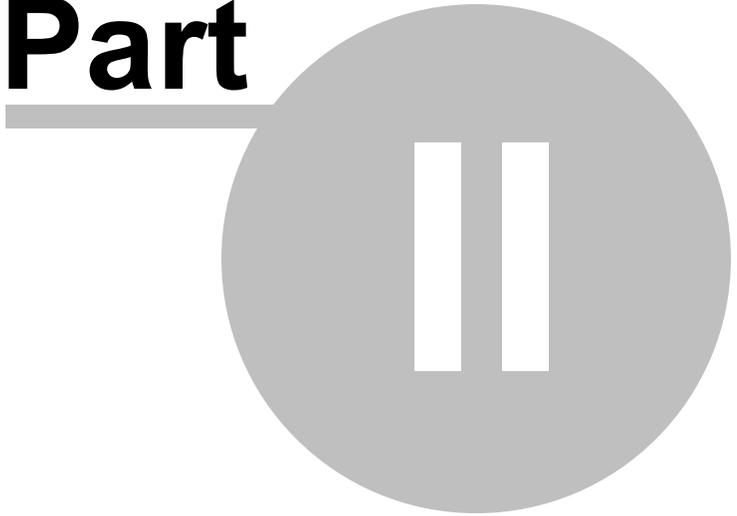
If you are running Windows Vista or later the driver stores the "INI" file in this directory:

C:\ProgramData\Astro-Physics\ASCOM

Security privileges (to "Users") must be given to this directory or else Windows will store info in:

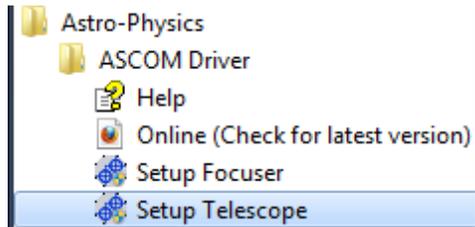
c:\users\\AppData\Local\VirtualStore\ProgramData\Astro-Physics\ASCOM

Part



2 Telescope Setup

To access the telescope setup window you can use the Windows menu: Start->Program Files->Astro-Physics->ASCOM Driver->Setup Telescope:



If you are using Windows Vista, Windows 7, or later operating system you may see a UAC dialog asking if it is OK to run APSetup.exe. You must click Yes to continue.

ASCOM Setup

Here is the Telescope Setup window:

AP V2 Driver ASCOM Setup

Astro-Physics GTO Mount
 ASCOM V2 Telescope Driver - v5.40.01

Mount Configuration

Mount Type: 1100 GTO

Controller: GTO CP4

COM Port Details

IP Addr APCC Virtual Port

Port: COM5

Timeout: 1000

Retry Count: 0

Use ASCOM Serial Object

Default Park/Unpark Positions

Unpark From: Last Parked

Park To: Current Position

Site Setup

Current Site: New Site

Latitude: N 37 00 00.0

Longitude: W 121 00 00.0

Elevation (meters): 100

Telescope

Aperture (mm): 105

Focal Length (mm): 670

? OK Cancel Reset to Defaults Advanced >>>>>

Note: the **Mount Type**, **Controller**, **Port**, and **Use ASCOM Serial Object** fields will be disabled if an ASCOM client program is already connected to the mount.

If you click the **Advanced >>>>>** button you will see additional controls:

AP V2 Driver ASCOM Setup

Astro-Physics GTO Mount ASCOM V2 Telescope Driver - v5.40.01

Mount Configuration

Mount Type: **1200 GTO**

Controller: **GTO CP3**

COM Port Details

APCC Virtual Port

Port: **COM5**

Timeout: **1000**

Retry Count: **0**

Use ASCOM Serial Object Check Port

Default Park/Unpark Positions

Unpark From: **Last Parked**

Park To: **Current Position**

Site Setup

New Save Cancel Delete

Refresh Sites Current Site: **New Site**

Latitude: **N** **37** **00** **00.0**

Longitude: **W** **121** **00** **00.0**

Elevation (meters): **100**

Get Latitude/Longitude from Mount

Telescope

Aperture (mm): **105**

Focal Length (mm): **670**

Initialization Setup

Sync Mount Time at Initialization Set Latitude/Longitude

Enable Mount Tracking on Unpark

Set Slew Rate: **600x**

Set PulseGuide/Guide Rate: **1.00x**

Set PEM: **Disable PEM**

Set RA Backlash: **0** Arc-sec

Set Dec Backlash: **0** Arc-sec

Connect Timeout (0 = never): **20** Seconds Windows Priority: **Above Normal**

Other Options

Enable Debug Log Open Log Directory Run Log Zipper

Keep Mount Time Synced to PC Time (Recommended)

Convert SYNCs to RCALs (HIGHLY Recommended)

Minimize control window on Connect (can still be opened from system tray)

Show In Taskbar when minimized

Check for new version when starting (highly recommended)

Auto-enable tracking when ASCOM clients send certain commands with tracking disabled (e.g. CCDAP, TheSkyX)

Calibrate move directions on first slew (recommended)

ASCOM RA MoveAxis = 0 Stops Tracking Async Park

Set driver windows on top Remember last window position

? OK Cancel Reset to Defaults SHRINK <<<<<<

Detailed explanations of each field follows in the next sections.

2.1 Mount Configuration

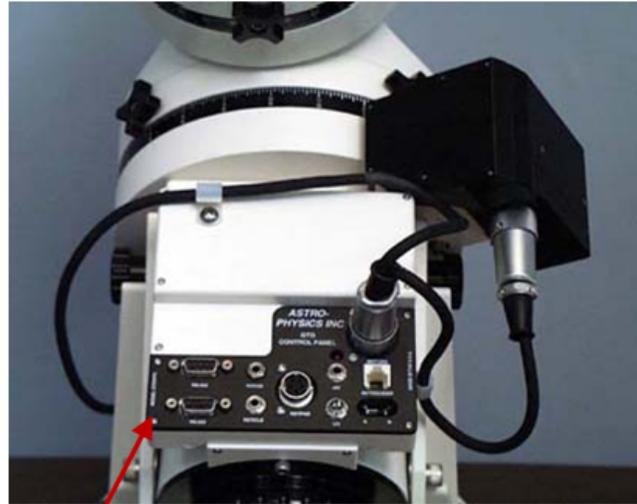
Mount Type: Select the mount type that matches your mount. In addition to the six Astro-Physics GTO models, there are three OEM manufacturers listed that use the Astro-Physics GTO Servo Control System.

Controller: Select the controller type. Most later mounts have the **GTOCP3** or **GTOCP4** controller. Mach 2 mounts only have the **GTOCP5** controller.

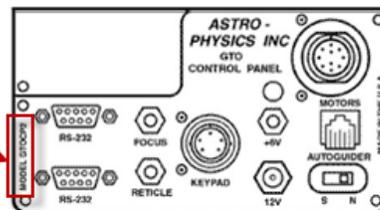
Note: It is important to set the mount controller to the correct type because the driver will send different commands depending on which controller it thinks it is talking to.



If you are unsure of the model take a look at the receptacle plate of the controller. It should have the model number printed on it just to the left of the two serial RS-232 ports (e.g. GTOCP2/3/4/5).



Model number



2.2 Connection Details

IMPORTANT: The two RS-232 serial ports on the GTOCP3 control box are NOT identical. There are two universal asynchronous receiver/transmitters, or UART devices that control serial communication in the GTOCP3.

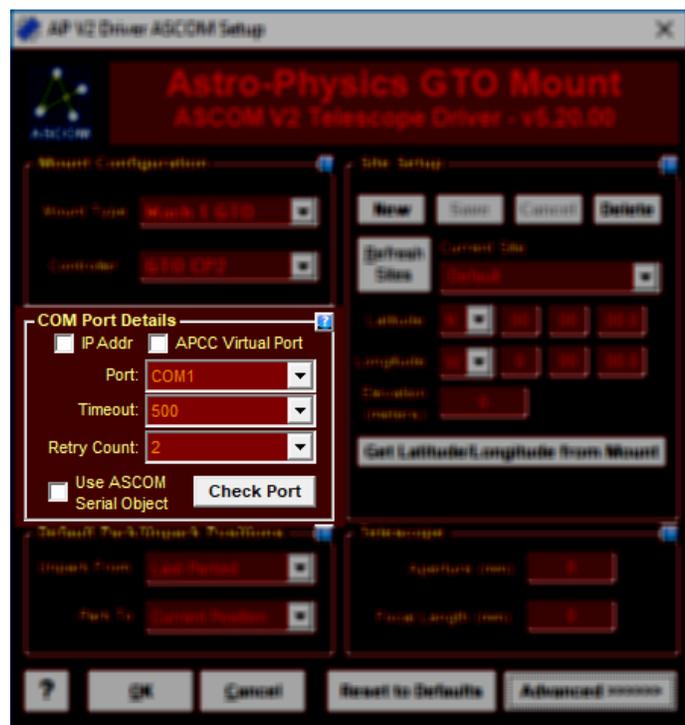
- **Top RS-232 and Keypad serial ports:** The primary UART is built into the EPROM chip that is the microcontroller “brains” of your mount. It is in fact a dual UART and it serves both the top RS232 port and the Keypad receptacle. This is why all keypad firmware updates must be done through the top port of the GTOCP3.
- **Lower RS-232 serial port:** The second UART is found on a field programmable gate array (FPGA chip) in the control box. While this UART is suitable for many applications, it does have certain limitation vis-à-vis the primary UART. Of particular concern to users of high demand (or high traffic) software, including the ASCOM V2 driver, is the lower over-sampling ratio in the second UART. This makes the lower RS232 port more susceptible to framing errors due to noise, differences in the number of start bits, baud rate mis-matches, etc.

The issue with the lower RS-232 port is not really a problem with either the port’s UART or the ASCOM V2 Driver, both of which work as they should. It is instead related to the PC hardware, and possibly how the operating system or system services are configuring it. The port selection is, however, the only aspect of this that we as end users have any control over.

IP Addr: This box should be "checked" to connect to a GTOCP4/5 equipped mount via Ethernet or WiFi. The "Port" field will change to "IP Address". After entering the IP Address (or symbolic name) you can check the connection by clicking the "Check Port" button.

Note: This option cannot be used with APCC (APCC has its own Ethernet and WiFi connection feature), nor with GTOCP1, GTOCP2, or GTOCP3 control boxes.

APCC Virtual Port: This box should be "checked" if you are connecting the ASCOM driver through one of APCC's virtual ports. Special robust handshaking between the driver and APCC occurs when this check box is checked.



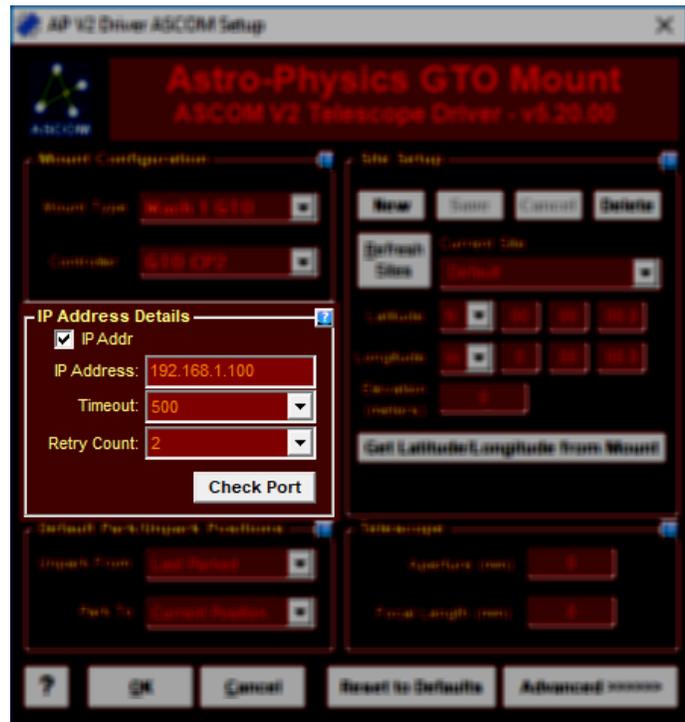
NOTE 1: APCC will usually auto-configure options in this group box, including this particular check box.

NOTE 2: It's OK to connect directly through the actual COM port (but not through APCC) with this option checked but an extra command sent will slightly delay the start-up of the driver until it discovers that APCC is not really there.

Port: The COM port on which the driver will attempt to communicate with the mount. Please note that this refers to the computer COM port as defined by the Windows Device Manager. It does not refer to either of the ports on the GTOCPx Control Box.

Timeout: the number of milliseconds to wait before retrying a command. Usually the mount will respond in less than 100 milliseconds so we recommend you start with 100 or 200 msec. If you experience timeouts try increasing the timeout. A higher timeout value will decrease the responsiveness of the driver if there are communications problems.

When the COM port is one of APCC's virtual ports command/response exchanges between the driver and APCC can require a higher timeout (200-500 msec). APCC optionally can set the timeout in the appropriate range but if you experience timeouts then check



that this setting is set appropriately.

Retry count: the number of retries before a command is considered failed. We recommend that you start with a value of 2. Multiple retries will decrease the responsiveness of the driver if there are communications problems.

Use ASCOM Serial Object: If this option is checked (the default) then the ASCOM library serial port interface is used. If for any reason you experience communications problems you can uncheck this option. In that case a custom C++ serial port interface is used.

Check Port: press this button to detect if the mount is connected on the COM port. **Please note:** The mount must be powered up for the driver to receive a response. The mount does not need to be initialized yet. If the query to the mount is successful the mount's firmware version will be displayed.

2.3 Default Park/Unpark positions

Unpark from: the scope position from which to unpark if the mount needs to be initialized.

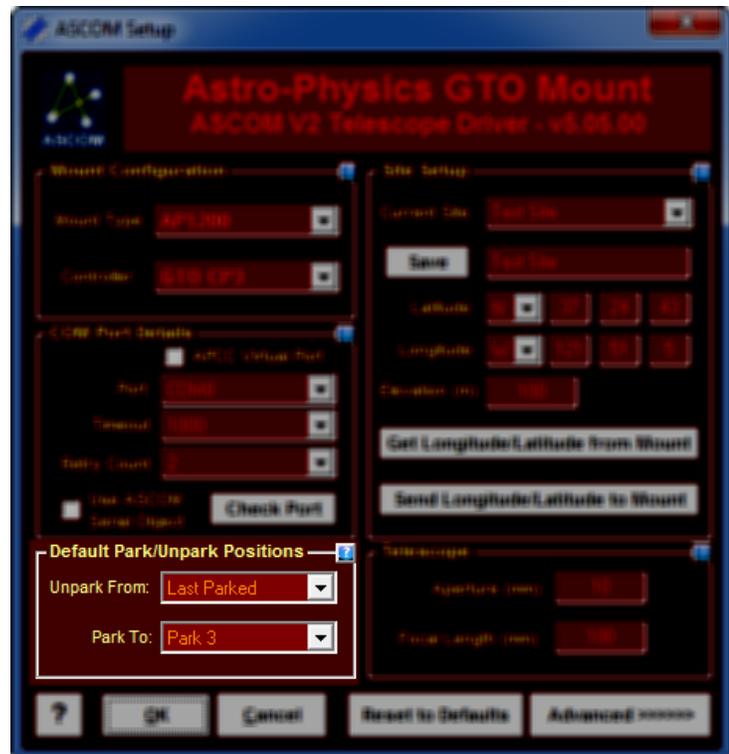
The mount will only be initialized when **Right Ascension = 0** and **Declination = 90°**. It is highly recommended to leave this setting as "**Last Parked**".

Note 1: The **Mach 2** mount always knows the mount position, even when moved with the clutches released, so the only choice will be **Last Parked**.

Note 2: If you do not wish to unpark the mount at start up then select "**Don't Unpark**".

Park To: the position to which the mount will be parked when an ASCOM Park command is received. Astro-Physics mounts have three Park positions. Please consult the mount's manual for descriptions of the park positions.

In addition to the three standard park positions you can define one custom park position at any Alt/Az coordinate. Remember that Astro-Physics mounts do NOT require parking at the end of a session!



IMPORTANT: If you have "Unpark From" set to anything other than "Last Parked", when you unpark the mount from an ASCOM client application a popup will come up to confirm that the mount is actually in that position. This is usually undesirable because human intervention (you, most likely!) will be required to continue. This is a safety precaution.

For instance, here is what could happen if the popup did not warn you -- say you parked to "Park 1" and had mistakenly had the driver set to unpark from "Park 3". Then, the mount would be initialized to the wrong position the next time it is initialized. That is, unless you physically moved the mount to **Park 3** first.

The popup is warning you to make sure the mount is in the correct position. But, "Unpark from **Last Parked** position" uses the park position stored in the mount's non-volatile ram the last time it was parked or shut off. No popup is needed in this case, so ASCOM clients will continue even when unattended. So, it is highly recommended to configure "unpark From" to **Last Parked**.

2.4 Site Setup

New: Click this to create a new site. After it is clicked you must change the Current Site, and fill in the Latitude, Longitude, and Elevation fields. Click **Save** afterwards to save the new site. You can also click **Cancel** to abort creating the site.

Save: Clicking this button will save the site settings to the database. If you make a change to one of the site fields or clicked **New** this button will become available.

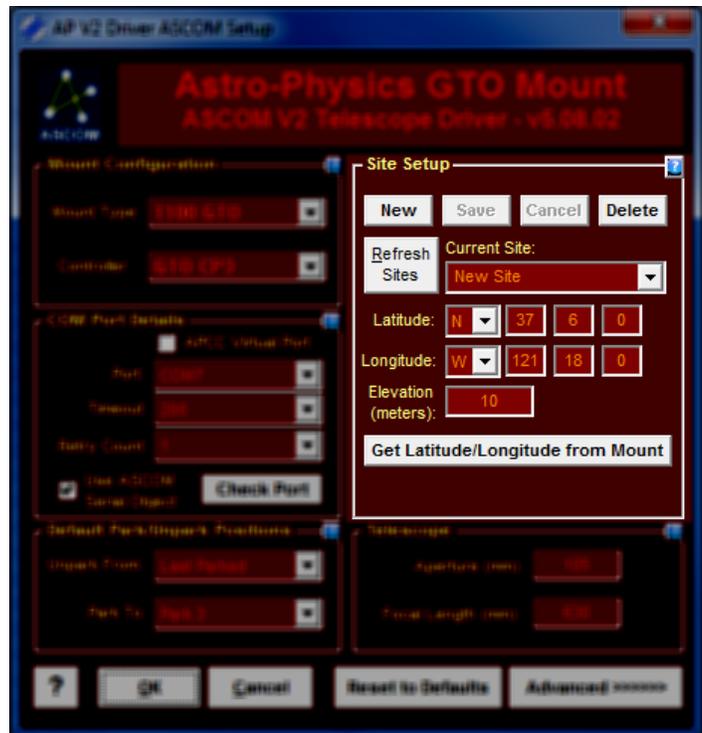
Cancel: If you make a change to one of the site fields or clicked **New** this button will become available. Clicking it aborts application of the change or the creation of a new site.

Delete: Clicking will delete the **Current Site**. A confirmation dialog will pop up to confirm the delete request.

Current site: A drop down list of sites. Select one of them to use it. You can change the site name by editing the text. After making changes click "**Save**".

Latitude: Latitude of the selected site. Latitude must be in degrees: minutes: seconds format.

Longitude: Longitude of the selected site. Longitude must be in degrees: minutes: seconds format.



TIP: You can enter a decimal number in the **degrees** field of **Longitude** and **Latitude** fields. The driver will calculate **minutes** and **seconds** after you press the TAB key or navigating away from the field.

Elevation: Elevation of this site in meters.

Get Longitude/Latitude from Mount: clicking this button will retrieve the longitude and latitude from the mount. The Longitude/Latitude fields will be filled in appropriately. To use this feature the mount must be powered on, initialized, and connected to your computer. The driver will attempt to connect to the mount using the specified COM port defined in the COM Port Details section.

2.5 Telescope

Aperture: Enter the primary telescope's aperture in millimeters.

Focal Length: Enter the primary telescope's focal length in millimeters.

Note: these fields are not specifically used by the driver but they are passed up to clients if the client asks for them.

The screenshot shows the 'Astro-Physics GTO Mount ASCOM V2 Telescope Driver' configuration window. The 'Telescope' section is highlighted with a white border, showing the following settings:

Field	Value
Aperture (mm)	10
Focal Length (mm)	100

2.6 RCAL versus SYNC

Sync and Recalibrate (RCal) – A Brief Explanation of the Differences

The Sync and Recalibrate commands are essential to the proper operation of your German Equatorial Mount. They allow the implementation of the meridian delay feature and movement of your telescope via the clutches. If used in the wrong way, the Sync and Recalibrate commands will cause the mount to slew incorrectly and possibly cause damage to equipment. They should be used with caution. The following information will provide a basis for understanding the purpose of each command. If you would like to have a more detailed explanation complete with diagrams, please consult the most recent version of the GTO Keypad Manual in the Technical Support section of the Astro-Physics website.

SYNC

The Sync command, if used at all, is typically employed at the beginning of an observing or imaging session after your mount is polar-aligned. Sync tells the mount where it is pointing and defines which side of the mount is the telescope side, and which is the counterweight side. Sync assumes that you have placed your telescope on the proper side of the meridian, i.e. a telescope placed on the west side of the mount pointing to a star in the east. This assures that the telescope will be positioned on the proper side of the mount for all subsequent objects.

Sync can also be used during your observing session if you have pushed the telescope by hand to a new position. Each time you use Sync, you redefine the orientation of the telescope and counterweight shaft. If you use it incorrectly during your session, the mount may move in an unexpected direction.

Sync defines both where the scope is pointing and defines which side of the mount the telescope is on.

RECALIBRATE

Recalibrate (RCal) is the “tweak” command. It is quick and easy and is perfect for fine-tuning your pointing accuracy during your observing or imaging session. Recalibrate is used when you have used the Go-To function and will be centering the object via the directional buttons on the virtual handbox. RCal updates the mount's internal memory position for that object without changing the correct orientation of scope on top of mount. It does NOT send new RA and Dec coordinates to the mount.

Recalibrate is ONLY intended to confirm the coordinates of the last Go-To slew. The idea is that you are telling the servo that it is actually still pointing exactly where the Go-To slew told the mount to point in the first place.

Since Recalibrate does not re-establish the mount's position in memory, it doesn't matter if the RCal object is past the meridian with the scope on the wrong side of the mount. It is therefore a MUCH safer command to use during your session.

Recalibrate reestablishes where the telescope is pointing, but does NOT redefine the position of the scope with respect to the mount.

SYNC VS. RECALIBRATE IN PLANETARIUM PROGRAMS

It is important to note that external software programs, including programs that use the ASCOM interface, may not make the same distinction between the 2 terms (most only have Sync as an option). YOU MUST BE CAREFUL when using a Sync or Recalibrate (or whatever they call it) from a client software program! Most often, only the Sync command is provided, which will encourage you to use it when your intent is to Recalibrate. This may result in unintended consequences.

In order to protect your mount from erroneous instructions, the Astro-Physics V2 ASCOM driver provides the checkbox to "Use RCAL for Syncs." If this box is checked, all sync commands that are issued from the planetarium program will be translated into Recalibrate before it goes to your mount. We strongly advise that you keep this box checked unless you have just pushed the mount to a new position by hand via the clutches. Then, once synced to the new RA and Dec coordinates, please remember to re-check the box so that you will be protected.

Unfortunately we cannot prevent all errors. If you select an object on the planetarium screen and then select Sync before you slew to the object, you will inadvertently calibrate on those coordinates. You must be careful!

2.7 Advanced Options

Clicking the **Advanced >>>>>** button will expand the setup window and show additional options.

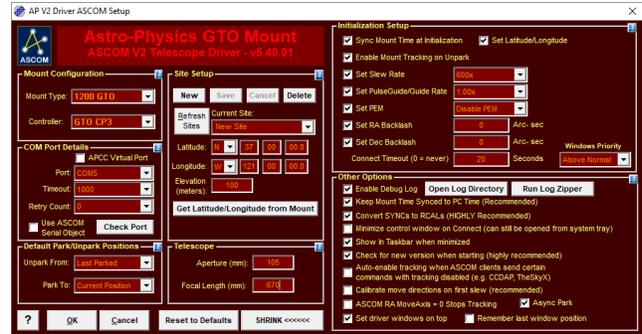


Once opened the ASCOM Setup form should look similar the figure to the right. The parameters discussed in the next two sections are used whenever the driver needs to perform mount initialization. Mount initialization is needed after the mount is powered on.

The hand controller will initialize the mount if it is plugged in in and set to autoconnect = YES. However, if it is not then the driver or another application (like PulseGuide) must be used to initialize the mount.

The driver recognizes the mount has been power cycled by unique RA/Dec values (RA=0, Dec=90). When the driver reads these values it always initializes the mount. The initialization occurs even when the mount is power cycled with the driver connected.

Note: If the driver needs to initialize the mount and you have the driver configured to **UNPARK** from anything other than "**Last Parked Position**" the driver will popup a dialog box asking you which position to unpark from. In that case, unless you have manually moved the scope into a defined park position via the clutches, you would want to override that setting and unpark from "**Last Parked Position**".



2.8 Initialization Setup

NOTE: With the exception of **Connect Timeout** and **Windows Priority**, the options in this section apply **ONLY** when the driver has to initialize the mount. These settings are not set each time the driver connects. If the mount has already been initialized via the keypad, the driver, APCC, or another application.

After the mount is first powered on it is in a non-initialized state. The driver knows the mount is in this state because the mount returns Right Ascension = 0 and Declination = 90. The following options control what will be initialized by the driver:

Sync Mount Time at Initialization: If enabled, the PC's current time, date, and time zone will be set during the initialization process. The time is updated to within 1 second. If you desire to have the driver routinely check and keep the mount time and PC time synchronized, then also enable the option **Keep Mount Time Synced to PC Time** in the **Other Options** group box.

Set Longitude/Latitude: If checked the Longitude/Latitude of the Current Site ⁶⁵ will be sent to the mount.

Enable Mount Tracking on Unpark: By default after unparking the telescope ASCOM drivers are supposed to leave the mount in a non-tracking state. If this option is checked that behavior is overridden and tracking will commence automatically. **NOTE:** some client software overrides the ASCOM default and commences tracking immediately upon connection.

Set Slew Rate: If checked the slew rate value in the box will be set in the mount. If the control box is a GTOCP3/4/5 then a **Custom** rate can be set (1-1200 for all mounts except 3600GTO, which is 1-

900). Note: before every slew the driver again sets the rate to this value in case it has been changed by the Astro-Physics Keypad or another application).

Set PulseGuide/Guide Rate: If checked sets the guide rate to the selected value (0.25x, 0.50x, or 1.00x). The recommended value for autoguiding is 1.00x. Slower rates are for manual guiding with a cross hair eyepiece. If the ASCOM PulseGuide() function call is used by a client application the selected rate value is always sent preceding the PulseGuide command. This helps ensure that the move rate is always set to one of the guide rates and not a faster rate, which can happen if another application is changing the move rate.

NOTE: If you have a **GTOCP5** controller, the **Set PEM** option will not be present

Set PEM: If checked the selected PEM state is issued. Specifically you can force PEM to be enabled or disabled. If the option is not checked then the PEM state is not changed. By default PEM is off when the mount is initialized.

NOTE: If you have a **GTOCP4** or **GTOCP5** controller, the **Set RA Backlash** and **Set Dec Backlash** options will not be present.

Set RA Backlash: If checked sets the RA backlash value, which is in units of arc-seconds. The recommended value is 0.

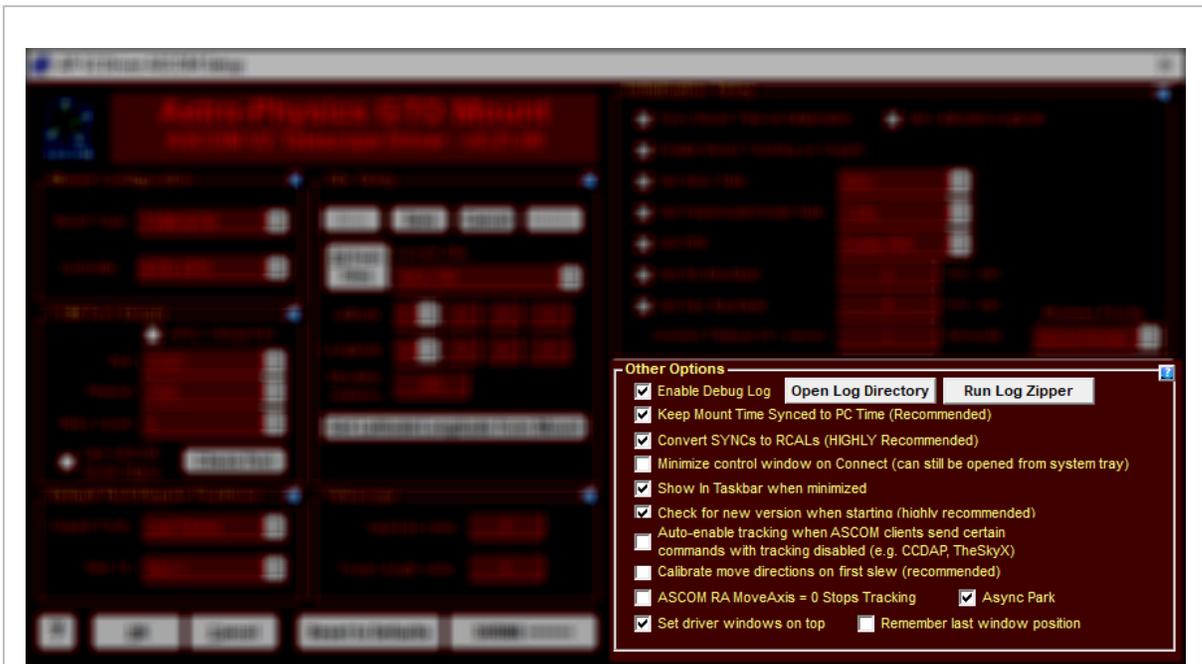
Set Dec Backlash: If checked sets the Dec backlash value. The recommended value is 0.

NOTE: For best results when autoguiding, Astro-Physics recommends using a backlash setting of 0. Backlash compensation is most appropriate for manual guiding and for visual use.

Connect Timeout: The timeout in seconds after which the driver will report back "failure to connect" to a client ASCOM application. Setting this to 0 will force the driver to keep trying to connect for an unlimited amount of time.

Windows Priority: The priority at which the driver will run. It is recommended to run "Above Normal".

2.9 Other Options



Enable Debug Log: when this option is checked the driver automatically will create a debug log file every time the first client connects.

Open Log Directory: Opens a Windows Explorer instance to view the files in the log directory.

Run Log Zipper: Opens the Log Zipper Utility [\[137\]](#).

Keep Mount Time Synced to PC Time (Recommended): If the mount's internal time differs by more than 2 seconds from PC time the driver will update the mount. Also, if the time zones don't match they will be adjusted to match.

IMPORTANT: If your mount has a GTOCP2, or GTOCP3 controller with Rev R or earlier firmware then:

Enabling **Keep Mount Time Synced to PC Time** will defeat the use of the Meridian Delay in the Astro-Physics hand controller. Do not try to use the Meridian Delay with this option enabled when the driver is connected to the mount.

Disconnecting the driver from the mount before using Meridian Delay in the Astro-Physics Controller.

Convert SYNCs to RCALs (Recommended): this will cause the ASCOM Sync function to do a RCAL (recalibrate) instead of a SYNC command.

If the mount is on the wrong side of the pier when a SYNC is done the mount will have an incorrect perception of which side of the pier the scope is on. Subsequent slews may cause a pier collision so it is recommended to leave this option checked. The driver will only send a Sync command to the mount when the mount is unparked from one of the three AP park positions or the user-define Alt/Az Park position.

For more information about "RCAL versus SYNC" please click this link.^[68]

Minimize control window on Connect: if this option is checked the virtual handbox window^[84] will not be visible when you connect an application to the telescope through the driver. The virtual handbox can then be accessed using the icon in the system tray^[86].

Show in Taskbar when minimized: When this option is checked the driver, when minimized, will show in the task bar, which makes it easier to open again. If unchecked, then when the driver's hand box window is minimized it does not show in Windows' task bar. In this case you can access the driver through it's icon in the System Tray^[86].

Check for new version...: if checked the driver will check for a new version via the web (internet connection required).

Auto-enable tracking when ASCOM clients send certain commands with tracking disabled: if not checked the driver will throw an exception if an ASCOM tries certain operations while tracking is off. The ASCOM client's operation will not be performed in that case. If enabled the driver will silently enable tracking and allow the ASCOM client's operation to execute.

Calibrate move directions on first slew (recommended): the East/West and North/South move directions can be reversed by commands in the driver and the mount's keypad. These are mostly useful when used with the mount's keypad. This option, which is enabled by default, will force a N/S/E/W calibration immediately before the first time a slew is done whenever the driver is run. The calibration takes less than a second so it should not cause any noticeable slowdown in telescope operations, but the start of the very first slew will be delayed so be aware that this is normal behavior.

NOTE: the Calibrate N/S/E/W routine is not needed when using APCC.

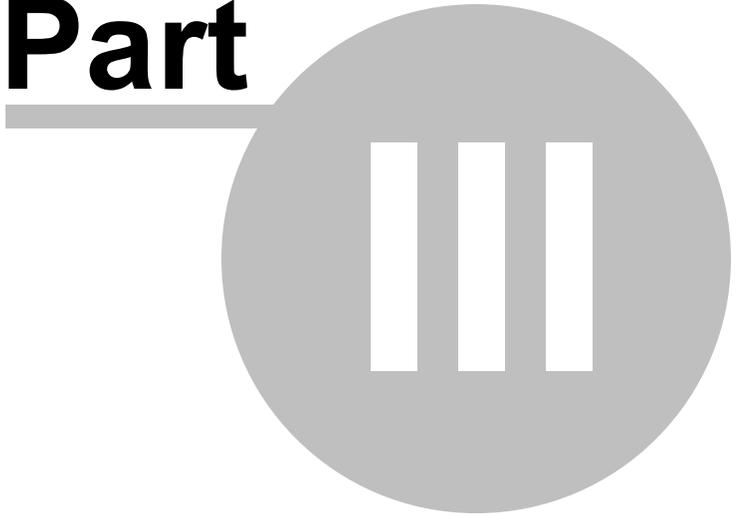
ASCOM RA MoveAxis = 0 Stops Tracking: when **unchecked** makes MoveAxis compatibility with most ASCOM clients. That is, when the option is unchecked and an ASCOM client sets the RA MoveAxis rate to 0 tracking will be returned to sidereal rate instead of stopped. Checking the option will produce the driver's old behavior where RA MoveAxis = 0 stops RA tracking.

Async Park: If disabled ASCOM client calls to the ASCOM Park() method will not return until the park operation has completed. If enabled, the ASCOM Park() method returns immediately and the ASCOM AtPark property must be polled to determine when the park operation has completed.

Set driver window on top: When enabled the ASCOM driver will remain on top of other windows.

Remember last window position: When enabled the last position of the driver before closing is saved and then restored the next time it starts.

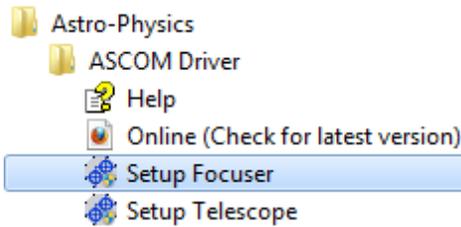
Part



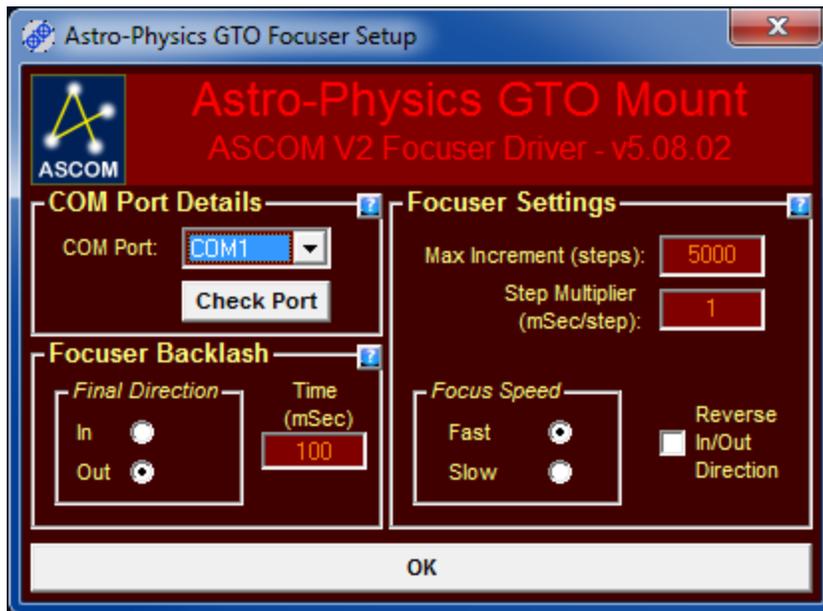
3 Focuser Setup

The Astro-Physics control boxes **GTOCP1**, **GTOCP2**, and **GTOCP3** have a focuser port that can be used to send voltages to a motorized focuser using a DC synchronous motor. Focusers requiring a driver cannot be controlled through the servo control box, but should have their own ASCOM drivers. Consult your mount's manual for more information.

To access the telescope setup window you can use the Windows menu: Start->Program Files->Astro-Physics->ASCOM Driver->Setup Focuser:



If you are using Windows Vista, Windows 7, or later operating system you may see a UAC dialog asking if it is OK to run APSetup.exe. You must click Yes to continue.



3.1 COM Port Details

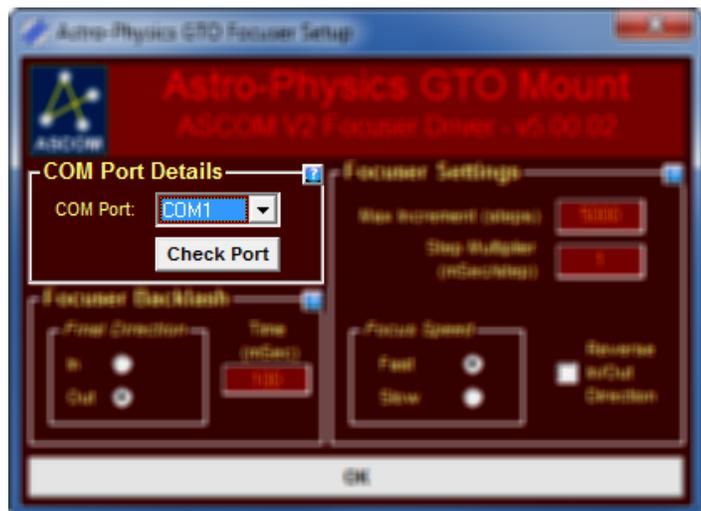
IMPORTANT: The two RS-232 serial ports on the GTOCP3 control box are NOT identical. There are two universal asynchronous receiver/transmitters, or UART devices that control serial communication in the GTOCP3.

- **Top RS-232 and Keypad serial ports:** The primary UART is built into the EPROM chip that is the microcontroller “brains” of your mount. It is in fact a dual UART and it serves both the top RS232 port and the Keypad receptacle. This is why all keypad firmware updates must be done through the top port of the GTOCP3.
- **Lower RS-232 serial port:** The second UART is found on a field programmable gate array (FPGA chip) in the control box. While this UART is suitable for many applications, it does have certain limitation vis-à-vis the primary UART. Of particular concern to users of high demand (or high traffic) software, including the ASCOM V2 driver, is the lower over-sampling ratio in the second UART. This makes the lower RS232 port more susceptible to framing errors due to noise, differences in the number of start bits, baud rate mis-matches, etc.

The issue with the lower RS-232 port is not really a problem with either the port’s UART or the ASCOM V2 Driver, both of which work as they should. It is instead related to the PC hardware, and possibly how the operating system or system services are configuring it. The port selection is, however, the only aspect of this that we as end users have any control over.

COM Port: Com Port to use. This port should be the same as what is set for the telescope. Additional COM port details can be setup in the Telescope Setup Dialog^[55].

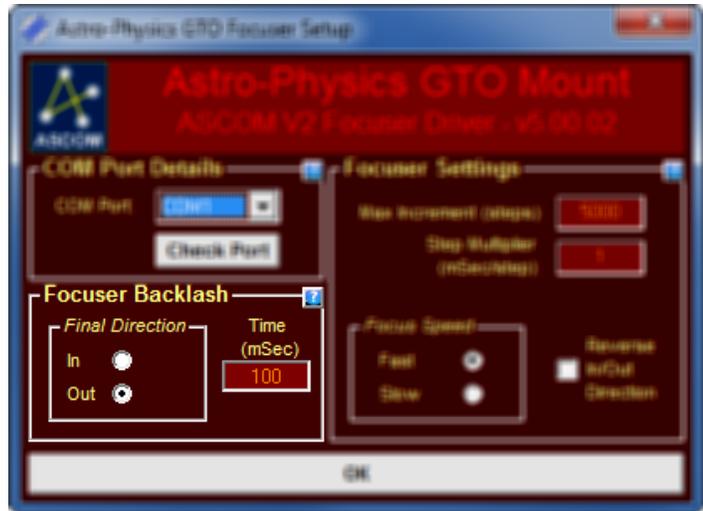
Check Port: click this to test if the mount is connected. The mount must be powered up for the driver to receive a response. It does not need to be initialized yet.



3.2 Focuser Backlash

Final Direction: This sets the final direction in the backlash compensation movements.

Time: This is the duration of the final backlash compensation movement.

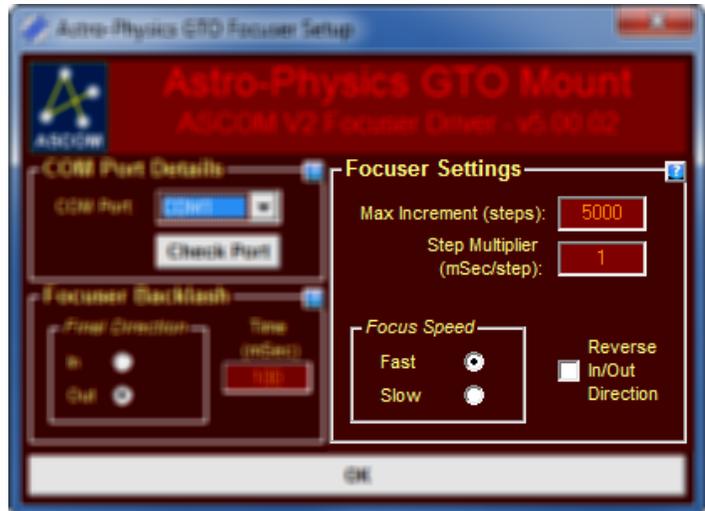


3.3 Focuser Settings

Max Increment: Maximum number of steps in or out that can be moved. In this implementation a step is a specific duration in milliseconds of movement. A step count is multiplied by **Step Multiplier** to get the number of milliseconds movement that will be performed. For instance if **Step Multiplier** is 2 and the ASCOM driver asks the focuser to move 10 steps then the focuser will move for $2 \times 10 = 20$ msecs.

Focus Speed: Fast or slow. Pick one and keep using it throughout a focusing session. There is no conversion value between Fast and Slow step movements.

Reverse In/Out Direction: If checked reverses the direction that an ASCOM command will move the focuser.



Part



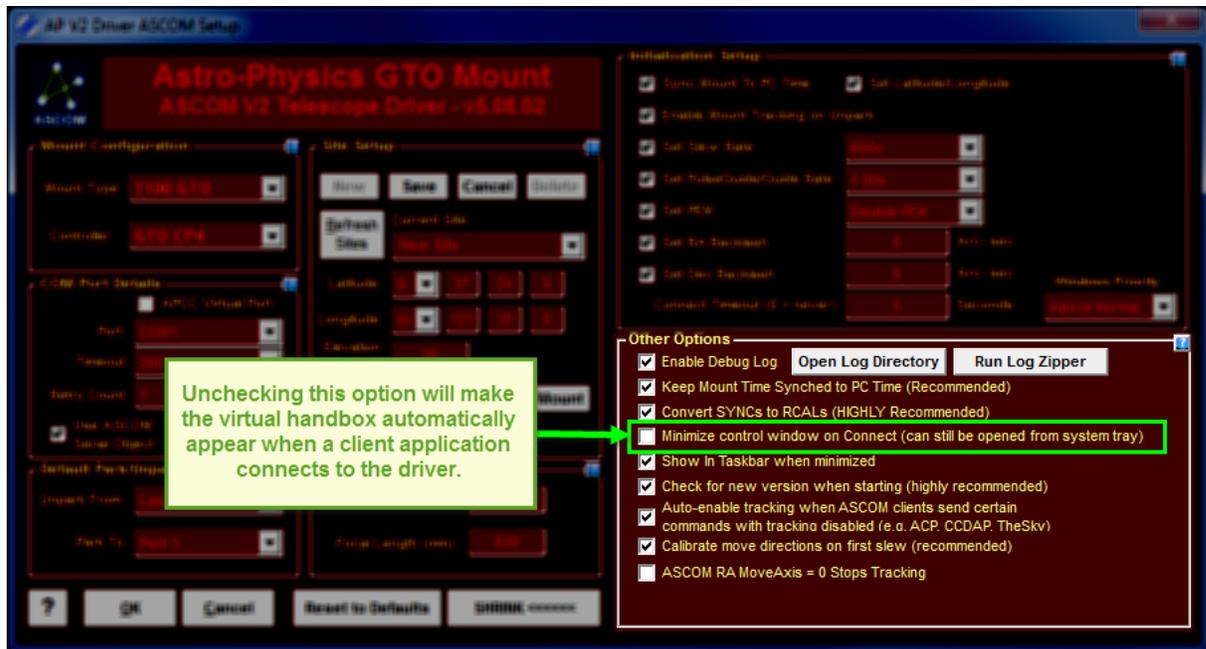
4 Handbox Window

The Astro-Physics V2 ASCOM driver's hand box window provides feedback on mount status and controls to do various operations.



NOTE: By default the hand box window will not be visible when you connect to the mount. To change this behavior you need to **uncheck the option to Minimize the control window in the Telescope setup window** ⁷⁴

First, click the **Advanced>>>>** to view the **Other Options** section. Then check the item as shown below:



Unchecking this option will make the virtual handbox automatically appear when a client application connects to the driver.

4.1 System Tray Icon

When the driver is running you should find the driver's **system tray icon** in the **system tray** as shown on the right. If you don't see it you may need to configure the properties of the **system tray** to make it visible all of the time.



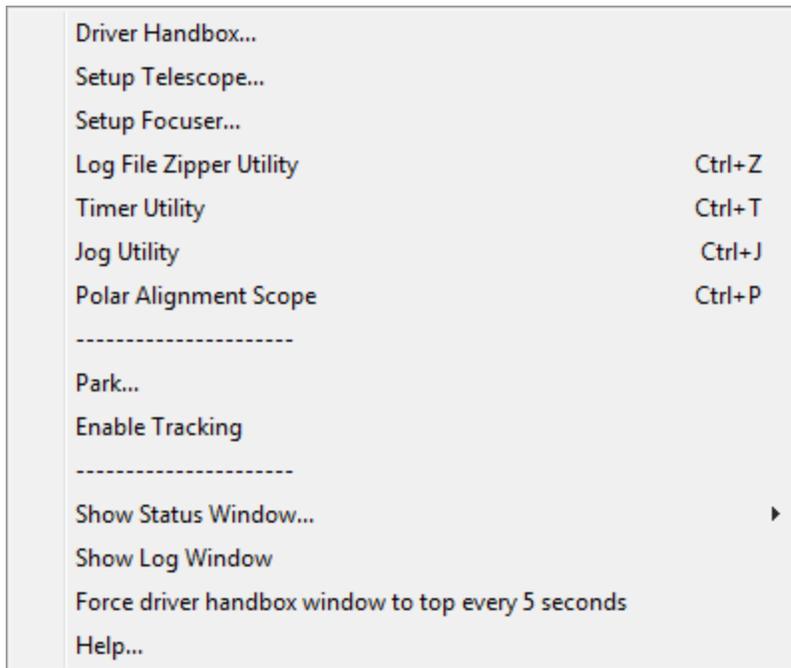
Hovering the mouse over the **system tray icon** will bring up the **Mount Status Window** shown below. The window will display for 5 seconds after the mouse leaves the **system tray icon** unless you check the option to keep it open.

NOTE: If you have a **Mach 2** mount the **PEM State** will not be shown as the mount has built-in encoders that remove periodic error.

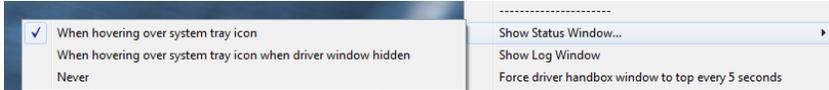
Astro-Physics Mount Status (Driver Version 5.40.01) x

Tracking Rate: Corr Sidereal	Control Box: GTOCP3	Connection: COM5
Guiding Rate: 1.00x	Firmware Rev: VCP4-P02-08	Mount Type: 1200 GTO
Move Rate: 0.25x	Latitude: N 37 00 00.0	Mount Time: 11:44:37
Slew Rate: 1200x	Longitude: W 121 00 00.0	Time Zone: -08:00:00
Park Status: Unparked*	Pier Side: West	PEM State: Enabled
Hour Angle: +04:31:21	LST: 17:59:10	Comm Errors: 0
RA: 13:27:49	ALT: +19:02:11	<input type="checkbox"/> Keep this window open
Dec: +02:30:35	AZ: 258:10:25	Stop All Motion

Right clicking the **system tray icon** brings up a menu of operations that you can perform. Possible menu items include:



Driver Handbox...	Opens the driver handbox ^[84] window or, if it is already open, bring it to the front.
Setup Telescope...	Opens the Telescope Setup ^[55] window.
Setup Focuser...	Opens the Focuser Setup ^[79] window.
Log File Zipper Utility	Opens the Log File Zipper ^[137] program (ApLogZipper). It allows you to package a set of log and configuration files when reporting a potential problem with your equipment or the ASCOM driver.
Timer Utility	Opens the Timer ^[136] program (ApTimer). It allows you to set a timer that will stop mount tracking or park the mount.
Jog Utility	Opens the Jog ^[135] program (ApJog). It allows you to slew the mount precise distances from its current location.

Polar Alignment Scope	Opens the Right Angle Polar Alignment  program.
Park...	Opens the Park options window.
Unpark...	Opens the Unpark options window.
Disable Tracking	Stops mount tracking.
Enable Tracking	Starts mount tracking.
Show Status Window	 <p>Provides three options controlling the display of the Mount Status Window described above:</p> <p>When hovering over system tray icon: This is the default action and behavior of the Mount Status Window in versions 5.00.01 and earlier of the driver. When the mouse is hovered over the system tray icon the Mount Status Window will display.</p> <p>When hovering over system tray icon when driver window hidden: the Mount Status Window will display when the mouse is hovered over the system tray icon and the driver's virtual hand box is hidden .</p> <p>Never: this disables the display of the Mount Status Window.</p>
Show Log Window	If checked the log window will display when logging is enabled.
Force driver handbox window to top every 5 seconds	Used if you want to force the driver window on top when another application forces itself to the top and hides the driver window.

Help...

Opens this help file.

4.2 Top of Handbox

The top of the driver's hand box window contains some useful information and controls.

On the upper right the driver version number, type of mount, and mount firmware revision (FW:) are displayed.

Clicking the **ASCOM** button will open a browser window to the ASCOM site, <http://www.ascom-standards.org>.

To the lower left you will find the Clients count. A client is a piece of application software that wishes to communicate with your mount and/or focuser through the ASCOM platform and the Astro-Physics ASCOM V2 Driver. Examples might include your planetarium program or autoguiding software.

To the left of the slash is the number of Telescope clients currently connected. To the right of the slash is the number of Focuser clients currently connected.



If you ever have a problem with a client application not releasing itself from the driver you can close the driver forcefully by double-clicking the **Clients** label (see the yellow arrow in **Figure 1** to the right). This will bring up the close dialog shown in **Figure 2**.

This method is used to prevent people from accidentally closing the driver by accidentally clicking the close icon, which might leave ASCOM client applications hanging.



Figure 1: Double click Clients label if you need to close the driver.

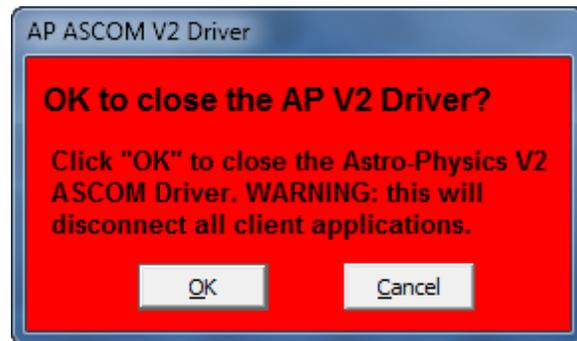


Figure 2: Dialog asking if it is OK to close the driver.

If mount communications fail the text at the top of the driver hand box will turn yellow with blue text. Also the **LST**, **RA**, **DEC**, **AZ**, and **ALT** fields will soon turn blank.

If you click the Blue/Yellow text region the hand box will open to the page with Communications errors ¹²⁴.

The screenshot shows the Astro-Physics V2 ASCOM Driver interface. The top section is highlighted in yellow with blue text, indicating a communication error. The text in this region reads: "Astro-Physics V2 Driver: v5.09.04", "400 GTO GTOCP4", and "VCP4-E01-04". Below this, the "Clients" section shows "1 / 0" and an "EXPAND >>>>>>" button. The "Mount Information: COM1" section contains a table with the following data:

Site	New Site
LST	
RA	
DEC	
ALT	
AZ	
TIME	16:35:48
TZ	08:00:00
Pier Side	East
Park	Parked

The "Move Scope Controls" section includes a directional pad (NW, N, NE, W, STOP, E, SW, S, SE), a "Move Rate" dropdown set to "600x", and checkboxes for "Swap E/W", "Swap N/S", and "Rotate 90". The "Tracking Rate: Not Tracking" section shows a "STOP" button, a star icon, a moon icon, a sun icon, and a comet icon. Below these are "Cust RA: 0.00000" and "Cust DEC: 0.00000".

Click the top of the yellow region to open the communication errors page

Clicking the **Expand >>>>>** button makes additional controls visible. The Expand button splits into two buttons: **<<<** and **NEXT >>>**. This is shown in the images to the right and below.



Clicking <<< shrinks the driver window back down to its default size. Clicking the **NEXT >>>** button will cycle it through one of the other three pages.

You can view all the controls simultaneously by checking **Expand window to show all controls**.

Each of the sections in the driver are explained in the following sections.



4.3 Mount Information

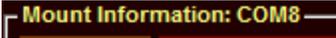
The **Mount Information** group box contains status of the mount.

Logging Paused

The screenshot shows the 'Astro-Physics V2' software interface. At the top, it displays 'ASCOM' and 'Astro-Physics V2 Driver: v5.09.04'. Below this, it shows '400 GTO GTOCP4' and 'Firmware: VCP4.E01.04'. A 'Clients: 1/0' indicator is present, along with an 'EXPAND >>>>>' button. The 'Mount Info: COM3 (APCC)' section contains a table of mount parameters:

Site	New Site
LST	19:15:18
RA	18:45:01
DEC	-00:12:36
ALT	+51:43:57
AZ	192:16:40
TIME	15:52:34
TZ	08:00:00
Pier Side	East
Park	Parked

Below the table is the 'Move Scope Controls' section, which includes a directional pad (NW, N, NE, W, STOP, E, SW, S, SE) and a 'Move Rate' dropdown menu set to '600x'. There are also buttons for 'Swap E/W', 'Swap N/S', and 'Rotate 90'. At the bottom, the 'Tracking Rate: Not Tracking' section shows a 'STOP' button, a star icon, a moon icon, and a sun icon. Below these are 'Cust RA: 0.00000' and 'Cust DEC: 0.00000' fields.

<p>Logging Paused/Disabled</p>	<p>When logging is paused a yellow rectangle is visible in the upper left of the Mount information group box.</p> <p>Logging will automatically pause after the mount is parked for about 3 minutes so that the log file does not become enormous if the mount is to be left powered on all the</p> <p>When logging is disabled a red rectangular region is visible in the upper left of the Mount information group box.</p>	
<p>COM Port</p>	<p>The COM port is shown at the top of the mount Information group box. If the driver is using the APCC error checking protocol then "(APCC)" will follow the COM port name.</p> 	
<p>Site</p>	<p>The current site name is selected.</p> <p>NOTE: If this field is bright red, as shown below, then the site settings do not match the latitude and longitude that is currently configured in the mount. This may not be a problem but it could lead to a "lost mount" condition so it's best to correct this as soon as possible. To correct it you would need to either change the site settings</p> 	
<p>LST</p>	<p>This is the mount's Local Sidereal Time. The mount is queried once every 5 seconds. The displayed value is</p>	<p>©2021 Astro-Physics, Inc.</p>

Notes

1. When slewing or parking **RA**, **Dec**, **Az**, and **DEC** fields will blink. Click one of the blinking fields to abort the slew or park operation. A window will pop up to confirm that you wish to stop the slew.

4.4 RA/Dec Bookmarks

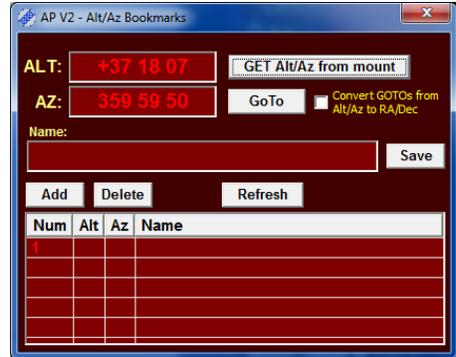
The **RA/Dec Bookmarks** window allows you to save RA/Dec positions in the sky to come back to at another time.

Num	RA	Dec	Name
1	17 06 01.2	+54 32 26	Test2

RA Dec	<p>The Right Ascension and declination values of the bookmark. You can either enter this manually or, if you click Get Ra/Dec from Mount, they will be filled in with the mount's current RA/Dec values.</p> <p>Also, if you click an entry in the table at the bottom of the window the RA/Dec and Description fields will be filled in.</p>
Descriptio n	An optional description for the bookmark.
Get Ra/Dec from Mount	Clicking this will fill in the RA and Dec fields with the current pointing location from the mount.
Goto	Clicking this button will slew the scope to the RA/Dec coordinates.
Save	Clicking this will save any changes you have made to RA/Dec/Description .
Add	Clicking this will add a new entry to the bookmarks table.
Delete	Clicking this will delete the selected entry from the bookmarks table.
Refresh	Reads the list from the database again. The RA/Dec bookmarks are shared with APCC so if you create a bookmark in APCC and switch to this window in the driver you may need to click this button.
Table	Click a row to select it. The RA ,

4.5 Alt/Az Bookmarks

The **Az/Alt Bookmarks** window allows you to save Az/Alt positions in the sky to come back to at another time.



Az Alt	<p>The Azimuth and Altitude values of the bookmark. You can either enter this manually or, if you click Get Alt/Az from Mount, they will be filled in with the mount's current Az/Alt values.</p> <p>Also, if you click an entry in the table at the bottom of the window the Az/Alt and description fields will be filled in.</p>	
Description	An optional description for the bookmark.	
Get Alt/Az from Mount	Clicking this will fill in the Az and Alt fields with the current pointing location from the mount.	
Goto	Clicking this button will slew the scope to the Az/Alt coordinates.	
Convert GOTOs from Alt/Az to RA/Dec	Converts the Alt/Az to an RA/Dec value for slewing. Used in some testing but not required any more. This option will probably be removed in a future release.	
Save	Clicking this will save any changes you have made to Az/Alt/Description .	
Add	Clicking this will add a new entry to the bookmarks table.	
Delete	Clicking this will delete the selected entry from the bookmarks table.	
Refresh	Reads the list from the database again. The Alt/Az bookmarks are shared with APCC so if you create a bookmark in APCC and switch	©2021 Astro-Physics, Inc.

4.6 Move Scope Controls

The **Mount Scope Controls** group box contains button controls that you can use to move the mount in real time..

<p>NW,N,NE</p> <p>W, E</p> <p>SW, S, SE</p>	<p>While pressing one of these buttons the driver will move the mount in that direction at the Move Rate selected.</p> <p>When the button is released the move will stop.</p> <p>Note: the directions (N=North, S=South, etc.) do not necessarily reflect actual compass directions. In some cases North may be swapped with South and East with West.</p>
<p>STOP</p>	<p>Pressing this button will send a command to the mount to immediately stop movement. This includes stopping a slew or park operation.</p>
<p>Swap E/W</p>	<p>Swaps the direction that the mount will move for East/West moves.</p> <p>Note: if you perform this operation and you are using an autoguider you may need to recalibrate.</p>
<p>The checkbox to the left of Swap E/W</p>	<p>Flips the positions of the NE/E/SE and NW/W/SW buttons.</p>
<p>Swap N/S</p>	<p>Swaps the direction that the mount will move for North/South moves.</p>



	Note: if you perform this operation and you are using an autoguider you may need to recalibrate.	
The checkbox to the left of Swap N/S	Flips the positions of the NW/N/NE and SW/S/SE buttons.	
Rotate 90	Rotates the position of the direction buttons by 90 degrees.	

4.7 Tracking Rate Controls

The **Tracking Rate** group box contains controls to set the tracking rate of the mount. When one of the five rate buttons are pressed a yellow bar is displayed over the button. This signifies the active rate. The selected tracking rate is also shown in the text of the group box.

Tracking Rate	<p>The text on the top of the tracking rate box shows the current rate.</p> <p>Not Tracking - the mount is not tracking Sidereal - tracking at sidereal rate King - tracking at King rate Lunar - tracking at lunar rate Solar - tracking at solar rate Custom - dual axis tracking at the custom RA and Dec rates Corr Sidereal - APCC Pro corrected sidereal rate Corr King - APCC Pro corrected King rate (not recommended, will double correct for refraction unless refraction correction is turned off in APCC Pro.)</p>
	<p>Click to stop the mount's tracking.</p> <p>Note: While the mount's tracking is off certain ASCOM functions are required to not operate (such as slewing). Please note that this is NOT a problem with the Astro-Physics GTO system or this driver!</p>
	<p>Clicking this button sets Sidereal tracking rate. If your mount has a GTOCP5 or GTOCP4 controller with P02-xx or later firmware, the Enable King Rate check box will be available. If enabled, the mount will track at the King rate.</p>



	<p>Clicking this button sets Lunar tracking rate. The lunar tracking rate is an average lunar rate in RA only. More precise lunar tracking including declination movement can be accomplished with the custom rates described below.</p> <p>Note: this option is not available when the driver is connected to APCC Pro and tracking rate modeling is enabled.</p>
	<p>Clicking this button selects Solar tracking rate.</p> <p>Note: this option is not available when the driver is connected to APCC Pro and tracking rate modeling is enabled.</p>
	<p>Clicking this button selects custom RA/Dec tracking rates.</p>
<p>Cust RA^{1,2}</p>	<p>The right ascension tracking rate <i>offset</i> from sidereal (seconds per sidereal second, default = 0.0)</p> <p>To use a custom tracking rate enter a value in the text box and click the "Comet" Icon. A client application can use the ASCOM property RightAscensionRate to set or read this value. When a client sets the rate the driver automatically switches to custom tracking rate mode.</p>
<p>Cust Dec^{1,3}</p>	<p>The declination tracking rate (arc-seconds per second, default = 0.0).</p> <p>To use a custom tracking rate enter a value in the text box and click the "Comet" Icon. A client application can use the ASCOM</p>

	property DeclinationRate to set or read this value. When a client sets the rate the driver automatically switches to custom tracking rate mode.
Enable King Rate	<p>This option is enabled if the mount has a GTOCP4 or GTOCP5 controller with P02-xx or later firmware.</p> <p>When enabled and sidereal rate is selected the mount will track at the King Rate and show Tracking Rate: King or Tracking Rate: Corr King.</p>

NOTES:

1. To use a custom tracking rate you need to have a **GTOCP3**, **GTOCP4**, or **GTOCP5** controller.
2. A Positive RA rate value means the mount will move clockwise faster than sidereal rate in the Northern Hemisphere, but slower than sidereal in the Southern Hemisphere.
3. A Positive Dec rate value means the dec axis is moving clockwise. When the mount flips the driver automatically applies an inverse factor. However, at regions near the pole where the telescope passes through the pole the direction may be opposite of what is expected.

4.8 Additional Configuration Settings

The **Additional Configuration Settings** group box contains miscellaneous controls and options.



Set Slew Rate

Select the slew rate in the drop-down combo box and click **"Set"** to immediately change the Slew Rate. Otherwise the slew rate will be changed the next time the driver is asked to slew the mount.

<p>Set Guide (and PulseGuide) Rate</p>	<p>Select the guide rate in the drop-down combo box and click "Set" to immediately change the Guide Rate.</p> <p>For best results when autoguiding, Astro-Physics recommends using a guide rate of 1X. Slower rates are for manual guiding.</p>
<p>Set PEM</p>	<p>NOTE: This field will not be shown if you have a Mach 2/GTOCP5.</p> <p>Select the option to enable or disable PEM (Periodic error correction) and click Set to apply.</p>
<p>Set RA Backlash</p>	<p>NOTE: This field will not be shown if you have a GTOCP4/5, which always defaults to a backlash of 0.</p> <p>Enter the Right Ascension backlash value in arc-seconds and click Set to apply. Astro-Physics recommends to leave this value=0.</p>
<p>Set Dec Backlash</p>	<p>NOTE: This field will not be shown if you have a GTOCP4/5, which always defaults to a backlash of 0.</p> <p>Enter the Declination backlash value in arc-seconds and click Set to apply.</p> <p>For best results when autoguiding, Astro-Physics recommends using a backlash setting of 0. Backlash compensation is most appropriate for manual guiding and for visual use.</p>
<p>Re-Sync Mount To PC Time</p>	<p>Clicking this button will resend the PC's time and time zone (and date if a GTOCP3/CP4/CP5) to the mount.</p>
<p>Use RCAL for Sync's</p>	<p>The ASCOM API has a several "Sync" functions which allow a client application to synchronize client-supplied RA/Dec or Alt/Az coordinates to the telescope's current position.</p> <p>Astro-Physics GTO mounts have two low-level commands for coordinate synchronization: SYNC and RCAL. RCAL is the same as</p>

	<p>SYNC except that RCAL can be done anywhere on any position with the scope in any position, on top or underneath the mount.</p> <p>"Sync" is only for setting up the scope versus the mount (i.e. whether the scope is set on top or underneath the mount - underneath being wrong). For the AP mounts, always think RCAL, not SYNC, when you want to redefine the position of the scope with regard to the sky.</p> <p>IMPORTANT: Astro-Physics strongly recommends that you keep the <i>Use RCAL for Syncs</i> option checked. Failure to do so can result in mount disorientation and possible equipment damage!</p>
Enable Debug Log	When this option is checked debug logging is enabled. Whenever the driver hand box window pops up so will the debug log window. Closing the debug log window does not stop logging. To disable logging uncheck this option.
Logs...	Clicking this button will open an instance of Windows Explorer to the directory where log files are kept.
Enable Mount Tracking on Unpark	<p>By default ASCOM drivers are supposed to turn off tracking after unparking. Checking this option changes that behavior.</p> <p>Please note that some clients will initiate tracking even though this box is left unchecked.</p>
Windows Priority	Sets the Windows priority at which the drive will run. "Above Normal" is recommended.
RA Polar Scope Tool	Clicking this button will open the A-0P Right Angle Polar Alignment tool.
Expand window to show all controls	Checking this option will simultaneously show all pages of the driver.

Zipper...	Opens the log file zipper utility.
Synchronous PulseGuide calls	<p>WARNING: Some .NET applications like PHD2 and CDC can cause driver deadlocks because they do not serialize driver calls on the same thread as is required by COM interop/ActiveX controls. To help prevent applications from causing deadlocks disable this option.</p> <p>If checked when a client ASCOM application calls the ASCOM PulseGuide() function the driver will not return until the operation completes.</p> <p>The default is for this function to be unchecked. In that case PulseGuide calls happen Asynchronously so overlapping RA and Dec PulseGuide calls can be made.</p>

4.9 Park/Unpark Settings

The **Park/Unpark Settings** group box contains controls to park and unpark the mount. The driver supports the 3 standard Astro-Physics park positions and one custom Alt/Az position.



Unpark

Click to perform an unpark operation. You should always unpark from **Last Parked** if you have not moved your mount between

	<p>imaging sessions.</p> <p>However, if you are setting up your mount you may want to unpark from one of the 3 standard mount park positions (see your mount's manual for descriptions/pictures of the three positions).</p> <p>If you have a mount with fixed park positions, like the Mach 2, the only choice will be to unpark from Last Parked because the mount always knows it's position, even when the clutches are loosened and the scope moved.</p>
Park	Click this button to start a park operation. The mount will slew to the position selected in the Park To drop-down list box.
Slew East Before Parking	<p>Sometimes when imaging a southerly object across the meridian the telescope may start to pass under the north side of the mount. If this happens when trying to park to AP Park Position 3 the scope could hit the pier as the mount tries to orient the scope north.</p> <p>To prevent this from happening select this option and set the number of hours to whatever you think is necessary. 6 hours equals one quarter rotation of the mount's RA axis. When a park operation starts the mount will "unwind" that number of hours if and only if the telescope OTA is on the West side of the pier.</p>
Park Alt Park Az	This is a user defined park position. You must slew to the position you would like to set as the Park Position and click Set Alt/Az Park Position . This can be especially handy for parking the mount with the scope aimed at a "flats screen."
Set Alt/Az Park Position	Clicking sets the user-defined Alt/Az Park position to the mount's current Alt/Az coordinates.

4.10 Reticle Brightness

The GTOCP1, GTOCP2, GTOCP3 control boxes have a reticle port that can be used to power an illuminated reticle. The reticle brightness can be controlled by the driver. The **Reticle Brightness** group box contains controls to adjust the reticle brightness.

Note: When the driver first connects to the mount it will go through a series of commands to ensure that the reticle is at the proper brightness.



Brightness	<p>There are 10 levels of brightness that can be set by moving the slider left or right.</p> <p>Moving the slider to the right increases output voltage on the control port and thus brightens the reticle.</p> <p>Moving the slider to the left decreases output voltage on the control port and thus dims the reticle.</p>
Re-Apply	<p>Clicking this button will send a series of commands to ensure that the reticle is at the proper brightness.</p>

4.11 Focuser Control

NOTE: These controls will only be available for GTOCP1, GTOCP2, and GTOCP3 control boxes. These controls will be hidden for the GTOCP4 and GTOCP5 control boxes.

The GTOCP1/2/3 control boxes have a focuser port that can be used to power a motorized focuser with a DC synchronous motor. A focuser connected in this manner can be controlled by the driver. The focuser can be moved manually by pressing the **In** or **Out** buttons, or from the ASCOM Focuser driver.

The screenshot displays the AP ASCOM Driver software interface. The main window is titled "AP ASCOM Driver" and shows various control panels. The "Focuser Control" panel is highlighted with a red box. It contains the following controls:

- Focus Speed:** Radio buttons for "Fast" and "Slow".
- Final Direction:** Radio buttons for "In" and "Out".
- Max Increment (steps):** A text box containing the value "5000".
- Step Multiplier (mSec/step):** A text box containing the value "1".
- Backlash Comp. (mSec):** A text box containing the value "100".
- Manual Focus:** A section with a "Reverse In/Out Direction" checkbox (unchecked) and two buttons labeled "In" and "Out".

Other visible panels include "Mount Information (COM1)" with fields for LST, RA, DEC, AZ, ALT, TIME, TZ, Flip Side, and Park; "Mount Scope Controls" with a compass and "Sweep" buttons; and "Site Setup" with fields for Current Site, Latitude, Longitude, and Diameter.

Here are descriptions of the settings:

Focus Speed: Fast or slow. Pick one and keep using it throughout a focusing session. There is no conversion value between Fast and Slow step movements.

Final Direction: This sets the final direction in the backlash compensation movements.

Backlash Comp. (mSec): This is the duration of the final backlash compensation movement in milliseconds.

Max Increment: Maximum number of steps in or out that can be moved. In this implementation a step is a specific duration in milliseconds of movement. A step count is multiplied by **Step Multiplier** to get the number of milliseconds movement that will be performed. For instance if **Step Multiplier** is 2 and the ASCOM driver asks the focuser to move 10 steps then the focuser will move for $2 \times 10 = 20$ msec.

In: While pressed moves the focuser.

Out: While pressed moves the focuser in the opposite direction of **In**.

Reverse In/Out Direction: If checked reverses the direction that an ASCOM command and buttons will move the focuser.

4.12 Telescope



The screenshot shows the AP ASCOM Driver interface. The 'Telescope' section is highlighted with a white box, displaying the following parameters:

- Aperture (mm): 160
- Focal Length (mm): 1100

Other visible sections include:

- Mount Information:** LST 00:33:57, RA 22:42:45, DEC -08:10:31, AZ 215:35:29, ALT +37:31:11, TIME 14:55:57, TZ 08:00:00, Flyer Side West, Park Unparked.
- Mount Control:** Focus Speed (Fast/Slow), Step Increment (steps), Step Multiplier, Backlash Comp., Focus Direction (In/Out), Manual Focus (In/Out), Focus.
- Telescope Control:** Aperture (mm), Focal Length (mm), Enable/Disable buttons.
- Site Setup:** Current Site, Save, Latitude, Longitude, Diameter (mm), Get Longitude/Latitude from Mount, Send Longitude/Latitude to Mount.
- Mount Setup:** Mount Type, Mount Rate, Sweep CW, Sweep NS, Rotate 90.
- Tracking Rate:** Sidereal, Equatorial, Alt/Az, Alt/Az DEC.

Aperture: The primary telescope's aperture in millimeters.

Focal Length: The primary telescope's focal length in millimeters.

Note: These parameters are not directly used by the driver. However client applications (such as planetarium program) can read these values from the driver.

4.13 PEM

NOTE: The PEM controls will be hidden if you have a Mach 2/GTOCP5 or an encoder mount with absolute encoders.

The screenshot displays the 'AP V2 ASCOM Driver' software interface. The title bar reads 'AP V2 ASCOM Driver'. The main window is divided into several panels:

- Mount Information (C-DEC):** Shows site information (Site: Home Site), LST (23:11:21), RA (20:15:55), DEC (+89:59:49), ALT (+37:18:07), AZ (359:59:50), TIME (15:24:55), TZ (08:00:00), Flip Side (View), and Park (Unparked).
- Telescope Control:** Includes Focus Speed (Fast/Slow), Focus Direction (In/Out), and Manual Focus (In/Out) buttons.
- Telescope Settings:** Shows Aperture (mm) and Focal Length (mm) settings.
- Site Info (C-DEC):** Displays Current Site (Home Site), Site Setting, Mount Actual, Latitude (N 37 40), Longitude (W 125 50), and Elevation (m).
- Tracking Data:** Features a compass rose and tracking status indicators.

A pop-up window titled 'PEM: Enabled' is overlaid on the right side of the interface, containing three buttons: 'Enable', 'Disable', and 'Record'.

PEM is the Astro-Physics implementation of periodic error correction. PEM status should be reflected in this group box's title if your mount has a GTOCP4 controller or GTOCP3 controller with Rev S or later firmware then

Enable: Enables the mount's periodic error correction facility.

Disable: Disables the mount's periodic error correction facility.

Record: Starts a PEM record, which will last the duration of one worm period. During that time

4.14 Site Setup

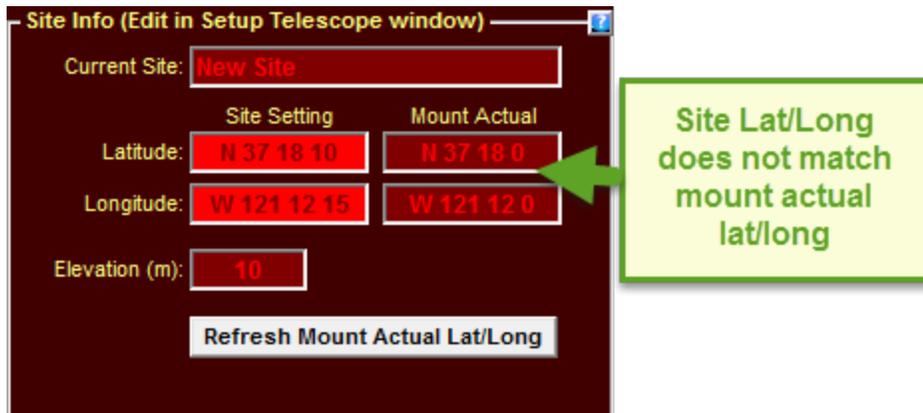


Current site: The current site. It can only be changed in the setup dialog^[65].

Latitude: The **Site Setting** shows the latitude for the current site. The **Mount Actual** shows the latitude retrieved from the mount. Ideally they should be the same. If there is a difference then the **Site Setting** value will be highlighted (see example below).

Longitude: The **Site Setting** shows the longitude for the current site. The **Mount Actual** shows the longitude retrieved from the mount. Ideally they should be the same. If there is a difference then the **Site Setting** value will be highlighted (see example below).

An example of mismatched site/mount latitude and longitude:

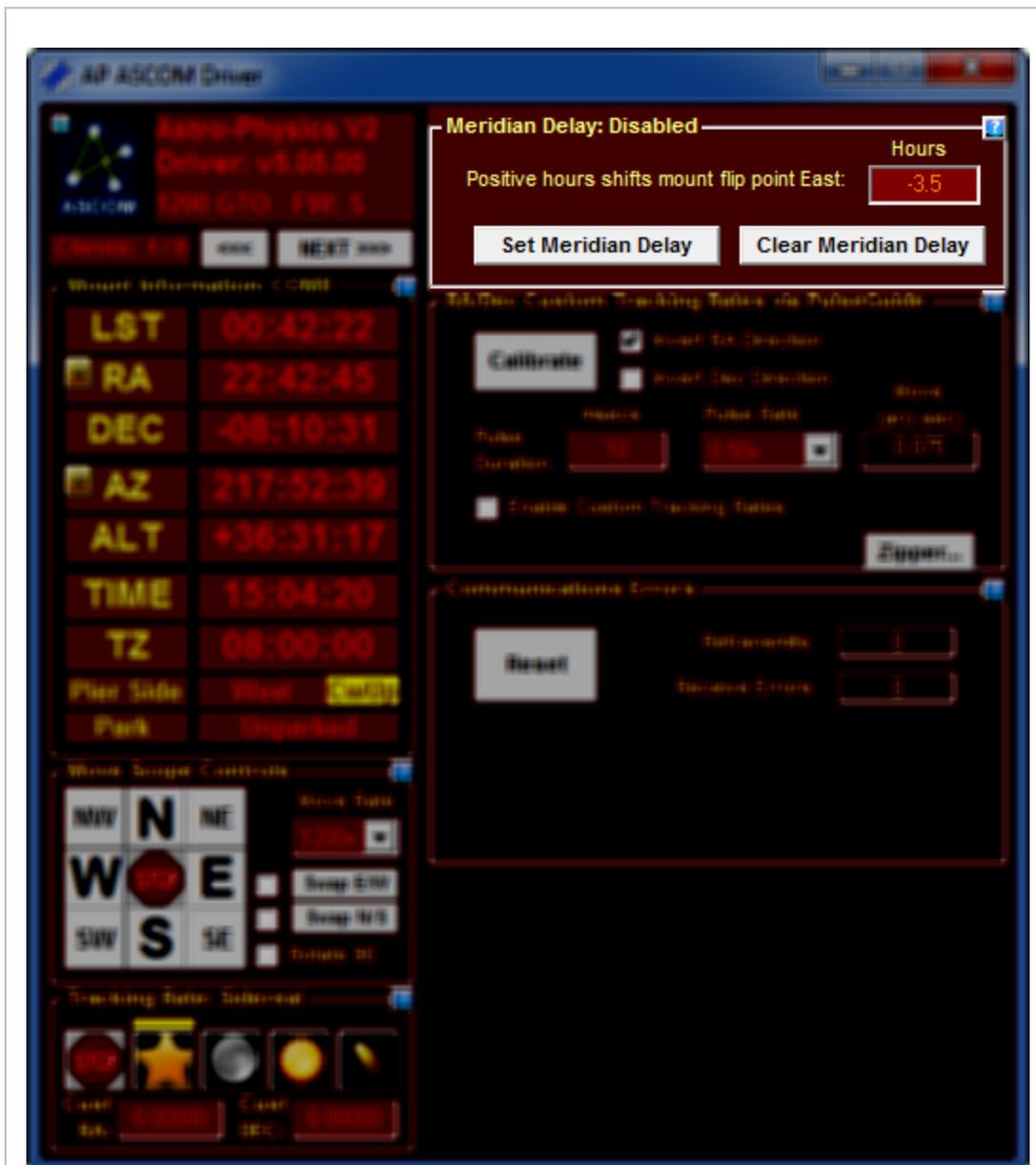


Elevation: Elevation of this site in meters. This value is not used directly by the driver but can be passed back to a client application through an ASCOM property.

Refresh Mount Actual Lat/Long: clicking this button will retrieve the longitude and latitude from the mount. The Longitude/Latitude fields will be filled in (but not the elevation).

Copy Lat/Long to Current Site: This button is not shown in the above pictures, but became available starting with v5.10.01. When clicked it will conveniently copy the Latitude and Longitude values to the current Site and save the values.

4.15 Meridian Delay



The driver supports a simulated meridian delay feature by adding an offset to the mount's time. For example, if the time is really 10PM and you press **Set Meridian Delay** with a meridian delay of -1 hours then the driver will set the time to 9PM even though it is really 10PM.

The time change affects which side of the mount will put the scope on when a slew is issued. If you specify meridian offset = 0 and you issue a GOTO to a star that is east of the

meridian then the mount will place the scope on the west side of the mount. A GOTO to a star west of the meridian will place the scope on the east side of the mount.

A positive Meridian Delay will simulate all objects being farther west than they really are. This will cause the mount to flip the scope to the east side of the mount (on a GOTO command) before the object reaches the meridian.

This allows you to track an object across the meridian until well after the meridian without risk of the scope hitting the pier.

IMPORTANT: Make sure you turn off the Meridian delay or Park the mount before powering down the mount or the next time it is initialized it will be offset by the Meridian delay offset.

The Meridian delay is automatically turned off when parking the mount manually from the driver's hand box or if a client application issues an ASCOM Park() function call.



Set Meridian Delay: Clicking this button will set the meridian delay. You can tell the Meridian delay is active by the tiny text box inside the **Time** text box as shown to the right.

Clear Meridian Delay: Clicking this button immediately restores the mount's time. The Meridian delay is also automatically cleared if you park the telescope.

Second important note: When operating with a non-zero meridian delay, the altitude and azimuth values reported by the mount (and therefore displayed in the driver's handbox window) will not be correct. Ignore these values while meridian delay is in effect.

4.16 Communications Errors

This group box summarizes the errors detected by the driver.

Retransmits: The count of the number of times a command needed to be resent.

Receive Errors: The count of the number of times the driver detected a received command was corrupted.

The following three error fields only become visible when one of the errors occur.

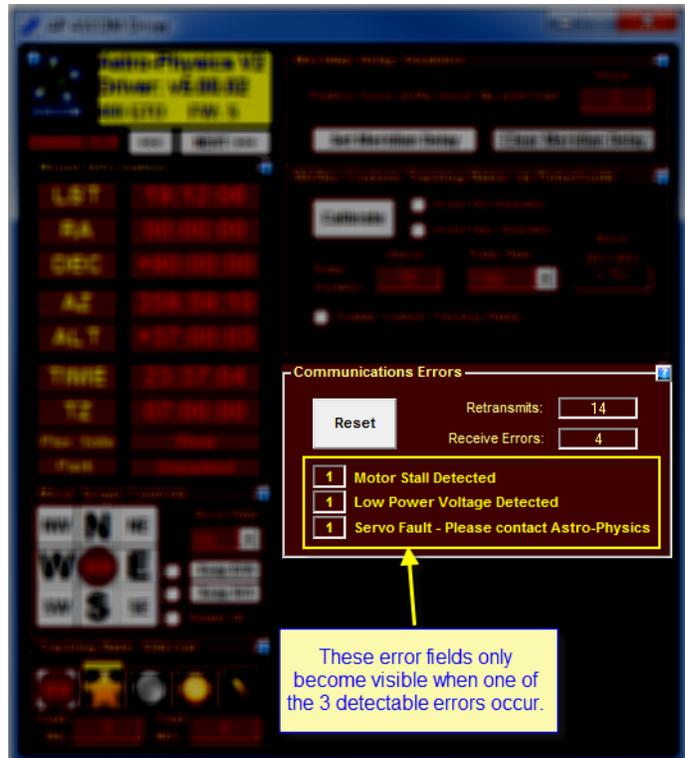
Motor Stall Detected: occurs when the motor is stalled. Make sure the telescope is well balanced. This error may occur if you disconnect the RA/Dec cables from the controller to the motors.

Low Power Voltage Detected: This will occur when power is removed or voltage is too low for the mount to operate correctly

Servo Fault - Please contact Astro-Physics: This error may occur if you disconnect the RA/Dec cables from the controller to the motors. If you did not disconnect one of the cables to the mount then contact Astro-Physics for help.

Reset: Click this button to clear out all of the errors.

Note: You can simulate the Motor Stall and Servo fault errors by disconnecting the RA/Dec connector from the control box.



You can simulate Low Power by
shutting off power to the mount.

4.17 FAQ

Q: What happens if power is lost and regained while the driver is connected?

The driver will automatically reinitialize the mount with the settings in the **Initialization Setup** group box.

Q: The driver's virtual window does not close when I disconnect from TheSkyX using TeleAPI. How do I properly shut down the APv2 driver when connected via TeleAPI in TheSkyX?

Bob Denny (author of the TeleAPI) wrote this on the ASCOM forum:

=====

From the ReadMe document that appears after the TeleAPI installation:

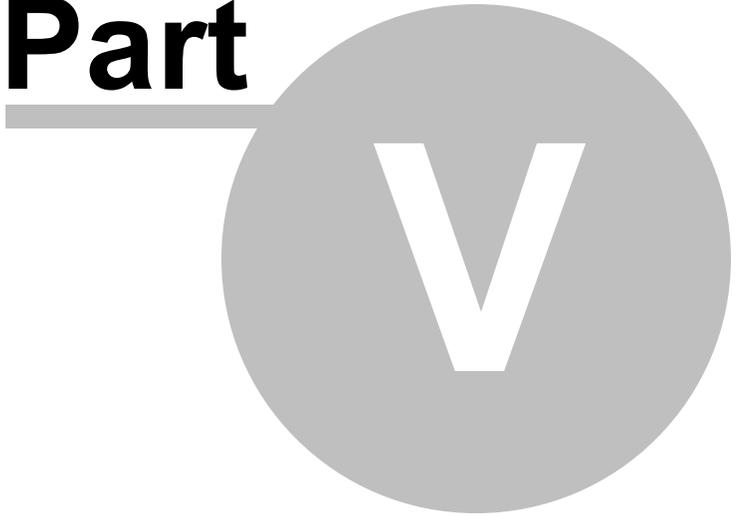
NOTE: Due to a complexity in TheSky X that is not present in TheSky 6, disconnecting from a telescope that has an executable driver will not automatically release and allow the driver executable to exit. If you wait long enough (up to 10 minutes), the executable driver WILL automatically release and exit. It's best to just let it exit on its own; if you want to have it end sooner you'll have to kill it with the Task Manager.

The AP driver is an executable driver, and it is showing the number of references to it; the above applies. You may find that the reference count will drop after 10 minutes. If you repeatedly connect and disconnect, it will keep adding to the reference count, and you'll have to wait the 10 minutes (or more) after the last one!

-- Bob

=====

Part



5 How to...

Set an Alt/Az Park position 

5.1 Set an Alt/Az Park Location

- 1) Slew to the desired park location via whatever means you want.
- 2) Click "Set Alt/Az Park Position".
- 3) Set the "Park To" combo box to "Alt/Az".

Part



6 Advanced Topics

Pier Side 

6.1 Pier Side

For historical reasons, this property's name does not reflect its true meaning. The name will not be changed (so as to preserve compatibility), but the meaning has since become clear. In a future version of the ASCOM standard, a synonym for this property will be added which better describes its meaning.

All conventional mounts have two pointing states for a given equatorial (sky) position. Mechanical limitations often make it impossible for the mount to position the optics at given HA/Dec in one of the two pointing states, but there are places where the same point can be reached in both pointing states (e.g., near the pole). In order to understand these pointing states, consider the following (thanks to Patrick Wallace for this info):

- All conventional telescope mounts have two axes nominally at right angles. For an equatorial, the longitude axis is mechanical hour angle and the latitude axis is mechanical declination.
- Sky coordinates and mechanical coordinates are two completely separate arenas. This becomes rather more obvious if your mount is an altaz, but it's still true for an equatorial.
- Both mount axes can in principle move over a range of 360 deg. This is distinct from sky HA/Dec, where Dec is limited to a 180 deg range (+90 to -90).
- Apart from practical limitations, any point in the sky can be seen in two mechanical orientations. To get from one to the other the HA axis is moved 180 deg and the Dec axis is moved through the pole a distance twice the sky codeclination (90 - sky declination).
- Mechanical zero HA/Dec is one of the two ways of pointing at the intersection of the celestial equator and the local meridian. Choose one, and once you're there, consider the two mechanical encoders zeroed.
- The two states are, then, (a) "normal", where the mechanical Dec is in the range ± 90 deg, and (b) "beyond the pole", where the mechanical Dec is outside that range.
- "Side of pier" is a *consequence* of the former definition, not something fundamental. Apart from mechanical interference, the telescope can move from one side of the pier to the other without the mechanical Dec having changed: you could track Polaris forever with the telescope moving from west of pier to east of pier or vice versa every 12h. Thus, SideOfPier is, in general, not a useful term (except perhaps in a loose, descriptive, explanatory sense).
- All this applies to a fork mount just as much as to a GEM, and it would be wrong to make the "beyond pole" state illegal for the former. You may not be able to get there if your camera hits the fork, but it's possible on some mounts. Whether this is useful depends on whether you're in Hawaii or Finland.

To first order, the relationship between sky and mechanical HA/Dec is as follows:

Normal state:

$$\begin{aligned} \text{HA_sky} &= \text{HA_mech} \\ \text{Dec_sky} &= \text{Dec_mech} \end{aligned}$$

Beyond the pole

$$\begin{aligned} \text{HA_sky} &= \text{HA_mech} + 12\text{h, expressed in range } \pm 12\text{h} \\ \text{Dec_sky} &= 180\text{d} - \text{Dec_mech, expressed in range } \pm 90\text{d} \end{aligned}$$

Astronomy software often needs to know which "side of the pier" (which pointing state) the mount is in. Examples include setting guiding polarities and calculating dome opening azimuth/altitude.

The meaning of SideOfPier, then is:

pierEast - Normal pointing state

pierWest - Beyond the pole pointing state

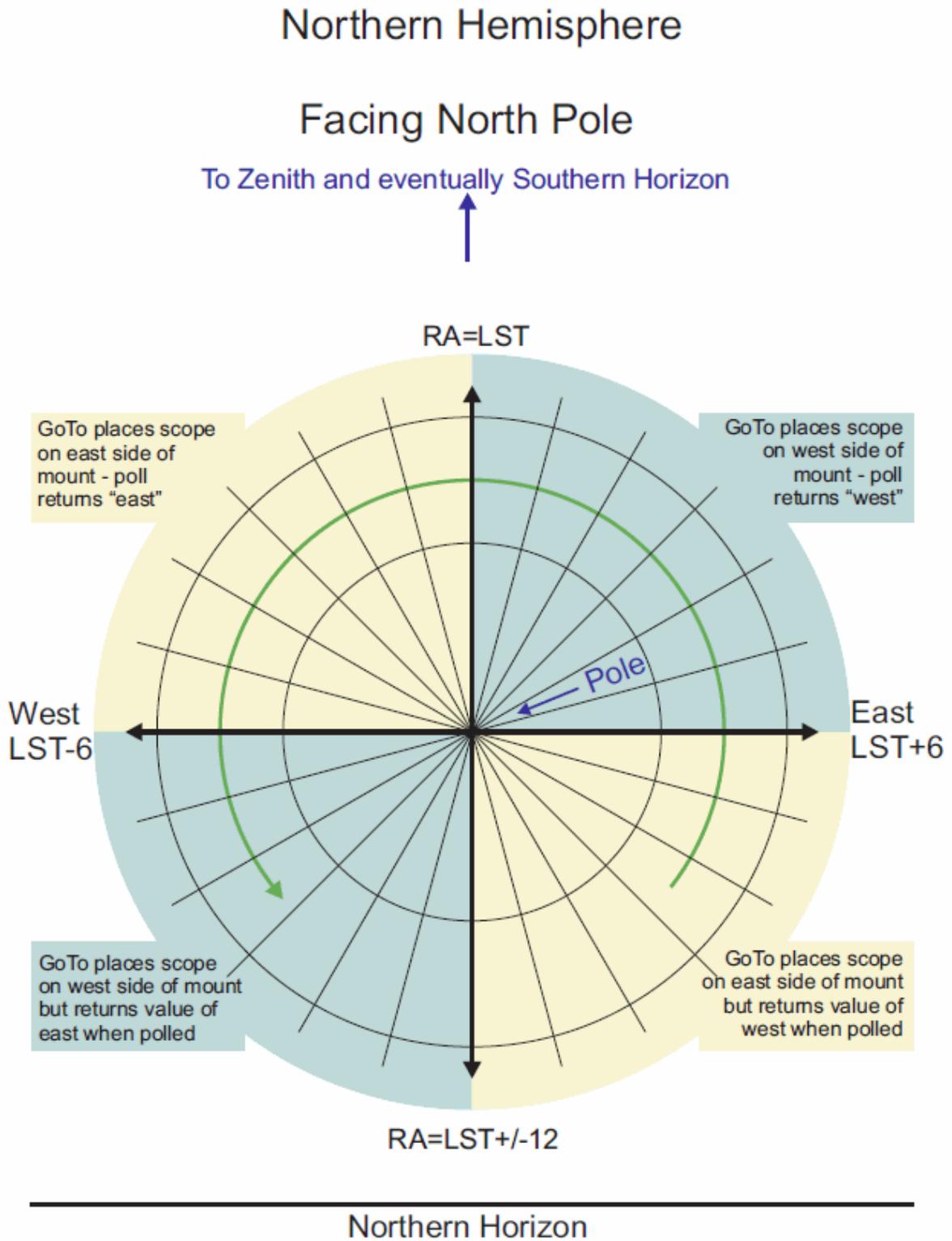
If the mount hardware reports neither the true pointing state (or equivalent) nor the mechanical declination axis position (which varies from -180 to +180), a driver cannot calculate the pointing state, and *must not* implement SideOfPier.

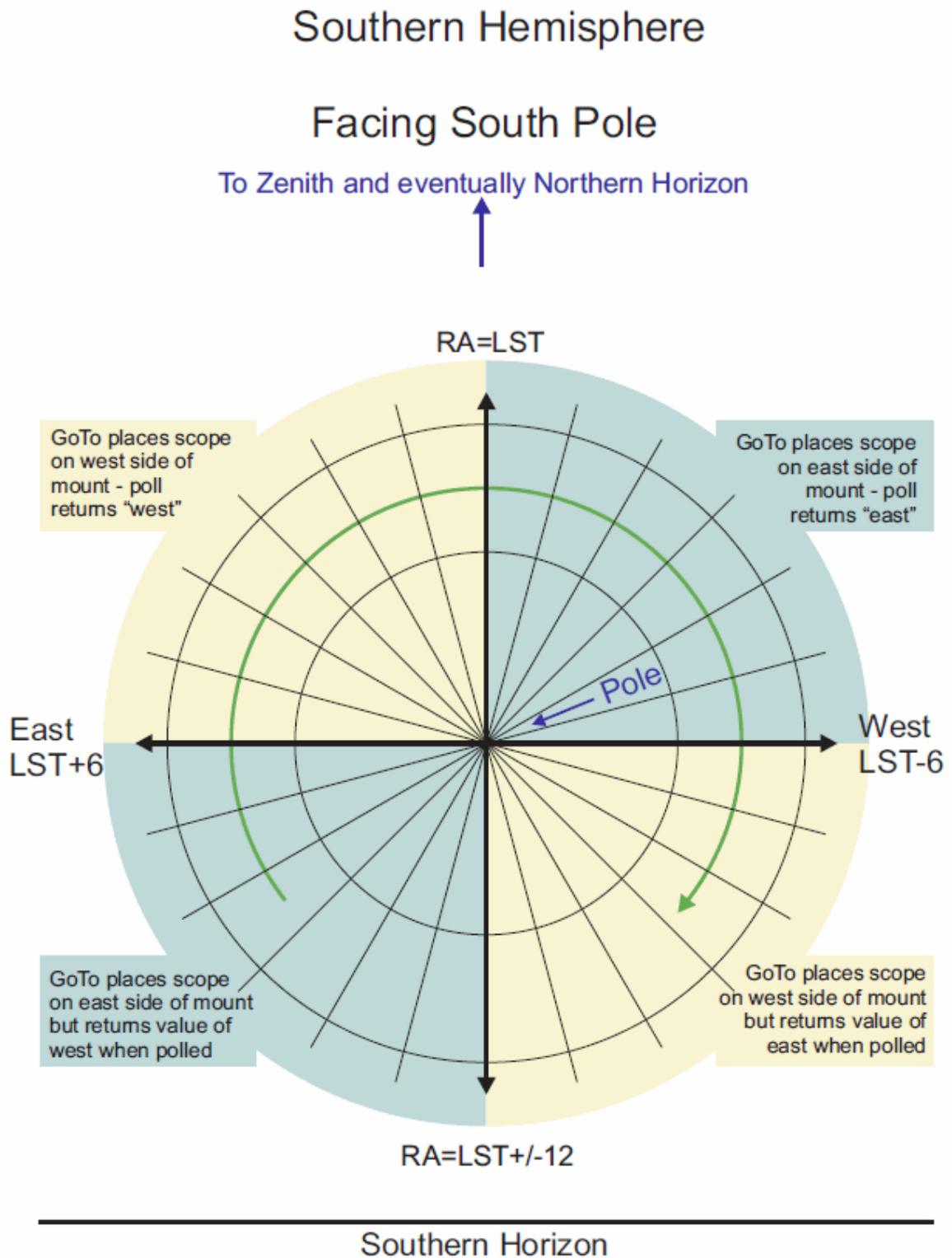
If the mount hardware reports only the mechanical declination axis position (-180 to +180) then a driver can calculate SideOfPier as follows:

pierEast = $\text{abs}(\text{mechanical dec}) \leq 90 \text{ deg}$

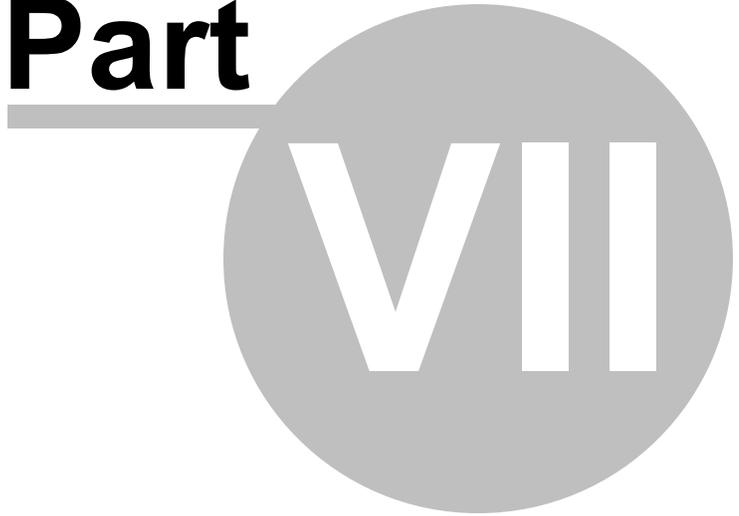
pierWest = $\text{abs}(\text{mechanical Dec}) > 90 \text{ deg}$

Here are pictures of the pier side value returned by the mount for the Northern and Southern Hemispheres:





Part



7 Extra Software Applications

There are four extra software applications included with the AP V2 driver:

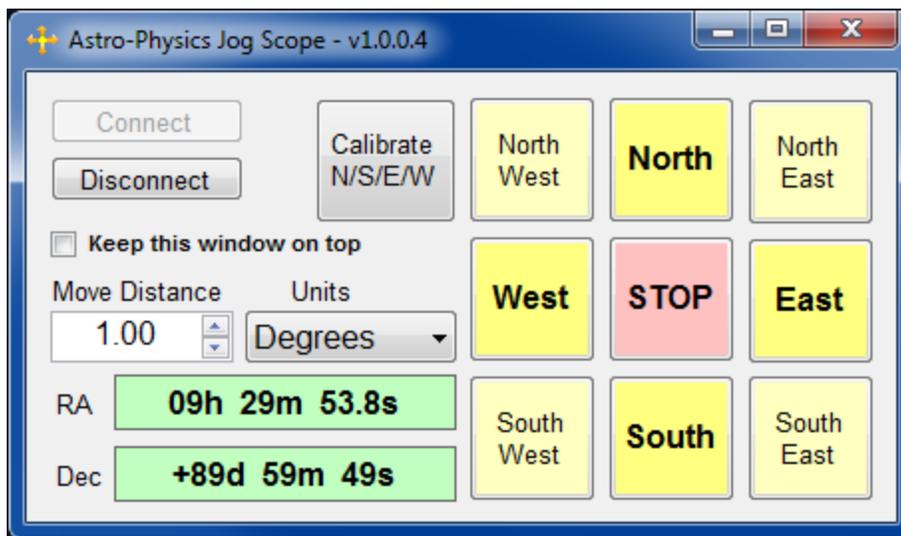
APJog¹³⁵ - used to slew the mount a user-defined distance.

APTTimer¹³⁶ - allows you to set initiate a timer, which after counting down to 0, will either stop mount tracking or park the mount.

APLogZipper¹³⁷ - combines the ASCOM driver settings file and log files for the last N number of days into a ZIP file. If you encounter a problem this utility is useful for providing Astro-Physics with all logs and settings.

AP Right Angle Polar Alignment Scope¹³⁸ - in combination with the Astro-Physics RAPAS (Right Angle Polar Alignment Scope) this utility identifies the precise position that Polaris (or Sigma Octantis in Southern Hemisphere) should be placed in the reticle for optimum polar alignment

7.1 APJog



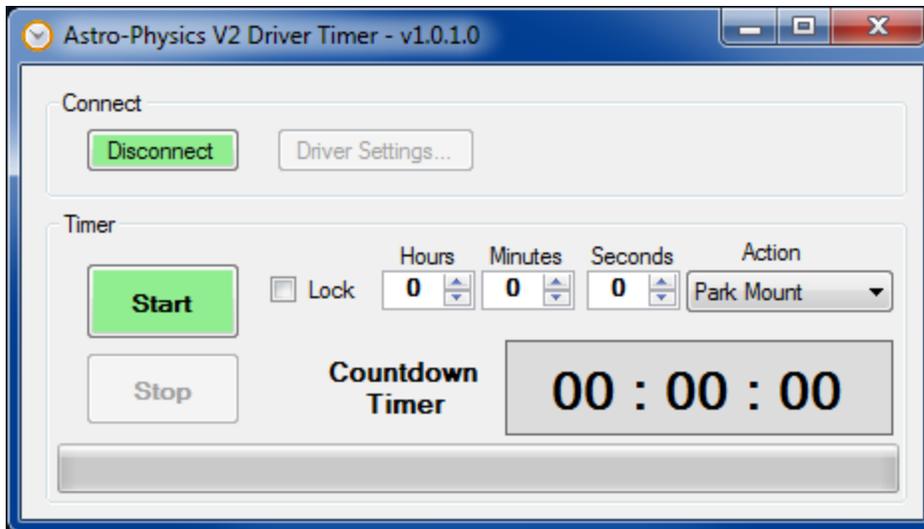
The **APJog** utility can be used to slew the mount an exact distance. To use this utility:

1. Click **Connect** to connect to the driver. If the driver is not already active it will start.
2. Select the **Move Distance** and **Units** that you would like the mount to move.
3. Click any of the **North/South/East/West** buttons to initiate a move.

If you need to stop a slew you can click the **STOP** button.

Calibrate N/S/E/W: Moves the mount a very short distance in RA and Dec to see if the button directions are reversed on each axis. If a direction is reversed it will be corrected so that autoguiding will perform correctly.

7.2 APTimer

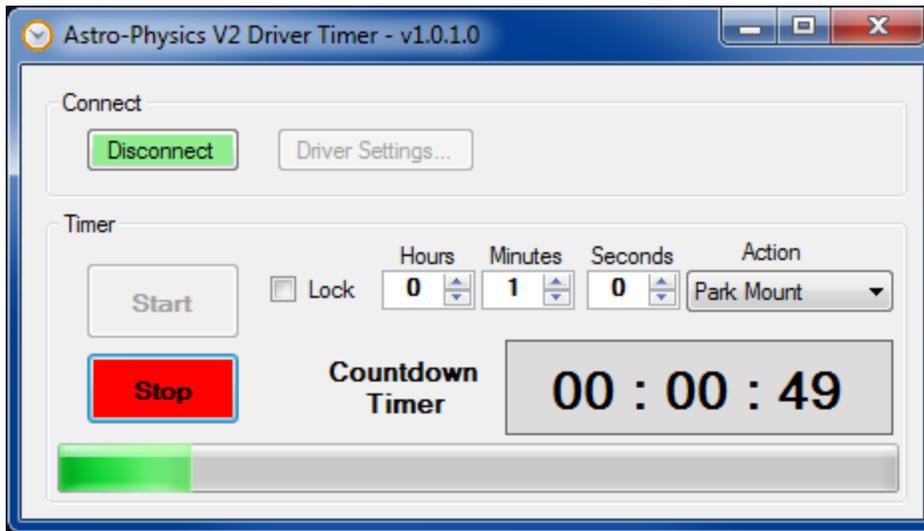


The APTimer utility allows you to set initiate a timer, which after counting down to 0, will either stop mount tracking or park the mount. To use this utility:

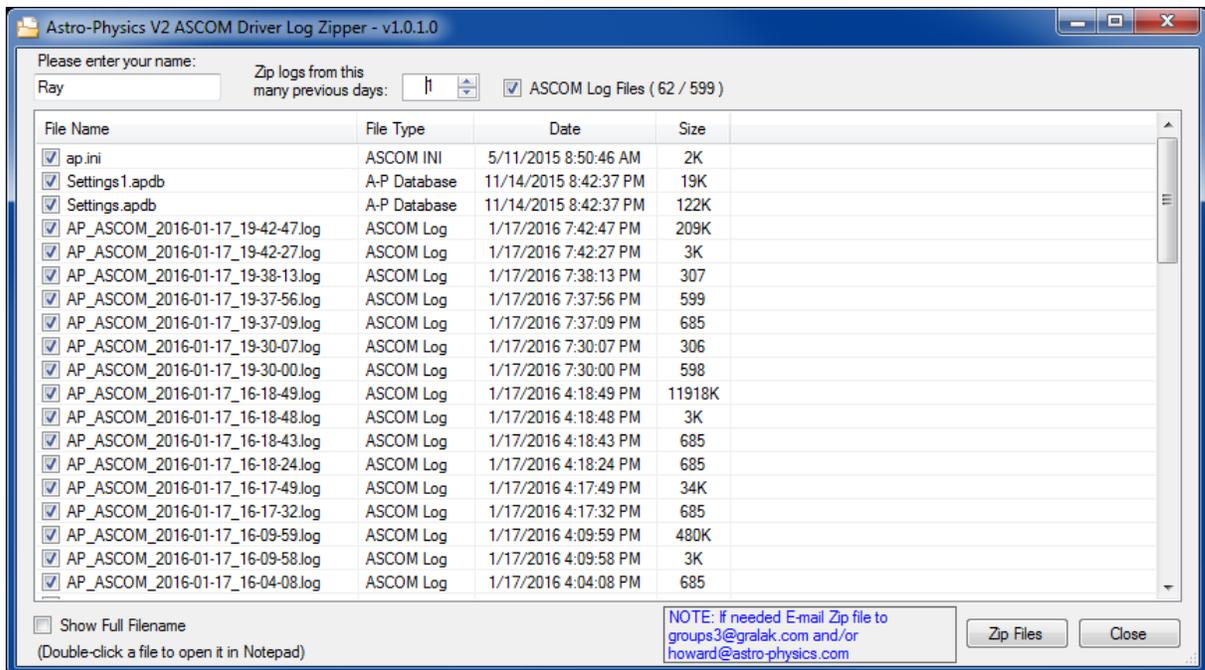
1. Click **Connect** to connect to the mount.
2. Set the countdown value in **Hours, Minutes, and Seconds**.
3. Select the **Action: Stop Tracking**, or **Park Mount**.
4. Check the **Lock** check box to prevent accidental changes to the time or action.
5. Click **Start** to start the action.

If you need to stop the timer click **Stop**.

There is a progress bar on the bottom which will allow you to visually see the relative amount of elapsed time:

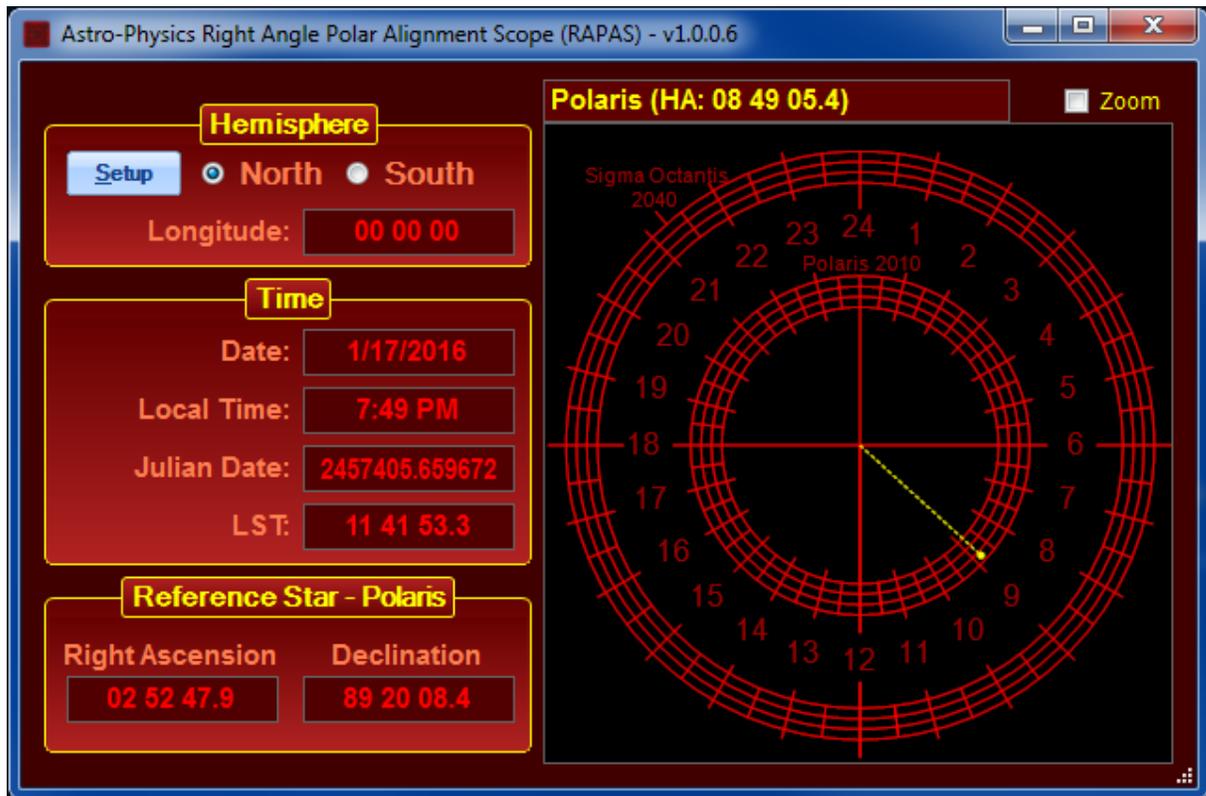


7.3 APLogZipper



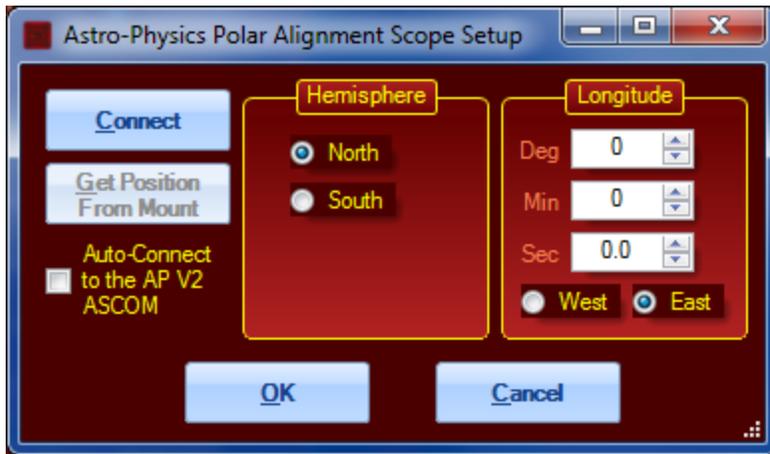
The AP Log Zipper utility will combine the ASCOM driver settings file and log files for the last N number of days. Using it is very simple. Just enter your name and select the number of previous days of logs to zip. You can uncheck individual files if you want. Double clicking a line in the table will open the log with notepad.exe. Click **Zip Files** to start the zipping process.

7.4 AP Right Angle Polar Alignment Scope



The AP Right Angle Polar Alignment Scope utility identifies the precise position that Polaris (or Sigma Octantis in Southern Hemisphere) should be placed in the reticle for optimum polar alignment. Aim your mount towards the appropriate star and adjust the mount's altitude and azimuth adjustment knobs until the star is positioned as shown in the application, which can be re-sized to full screen if needed.

Before using click the **Setup** button. The following setup dialog will pop up:



Select the hemisphere and enter the longitude of your location.

If "**Auto-Connect to the AP V2 ASCOM**" is checked then whenever this program is run it will try to automatically connect to the mount and retrieve the hemisphere and longitude.

Click **OK** to exit and save the settings.

Index

- . -

.Net Framework 3.5 31

- A -

Advanced >>>>> 55, 70
 Allow connect if mount not present 71
 ALT 95
 Altitude 95
 Aperture 67, 116
 ASCOM 31, 90
 ASCOM button 90
 ASCOM Setup 55
 ASCOM site 90
 AZ 95
 Azimuth 95

- B -

Backlash Comp. (mSec) 114
 Brightness 112

- C -

Check Port 60, 80
 Clear Meridian Delay 121
 Clients 90
 COM Port 80
 Controller 58
 Convert SYNCs to RCALs (Recommended) 74
 Current site 65, 119
 Cust Dec 103
 Cust RA 103

- D -

DEC 95
 Declination 95
 Disable Tracking 86
 Driver Handbox.. 86

- E -

Elevation 65, 119
 Enable Debug Log 74, 105
 Enable Mount Tracking on Unpark 71, 105
 Enable Tracking 86
 Expand >>>>> 90
 Expand window to show all controls 90, 105

- F -

Final Direction 81, 114
 Focal Length 67, 116
 Focus Speed 82, 114
 Force driver handbox window to top every 5 seconds
 86

- G -

G3600GTO 71
 Get Longitude/Latitude from Mount 65, 119
 GTOCP2 28, 31, 58, 103
 GTOCP3 28, 31, 58, 71, 103, 105

- H -

hand box window 84
 Help... 86
 hub 28

- I -

In 114
 Init Mount Now 105
 Initialize Mount 105
 Initialize Mount... 86
 Installing 33

- L -

Latitude 65, 119
 Local Sidereal Time 95
 Longitude 65, 119
 Low Power Voltage Detected 124
 LST 95

Lunar tracking 103

- M -

Max Increment 82, 114

MaximDL 39

Meridian Delay 95

Minimize control window on Connect 74

Motor Stall Detected 124

Mount Information 95

Mount Status Window 86

Mount Type 58

- N -

NEXT >>> 90

- O -

Observatory Control icon 39

Open Log Directory 105

Out 114

- P -

Park 95, 110

Park Alt 110

Park Az 110

Park To 63, 110

Park... 86

PEM 117

Pier Side 95

Pier Side,North 132

PierSide,South 133

Port 60

- R -

RA 95

Re-Apply 112

Receive Errors 124

Reporting Driver Problems 51

Reset 124

Re-Sync Mount To PC Time 105

Reticle Brightness 112

Retransmits 124

Retry count 60

Reverse In/Out Direction 82, 114

Right Ascension 95

Right clicking the system tray icon 86

Rotate 90 101

- S -

Save 65, 119

Send Longitude/Latitude to the Mount 65, 119

Servo Fault 124

Set Alt/Az Park Position 110

Set Dec Backlash 71, 105

Set Guide (and PulseGuide) Rate 105

Set Longitude/Latitude 71

Set Meridian Delay 121

Set PEM 71, 105

Set PulseGuide/Guide Rate 71

Set RA Backlash 71, 105

Set Slew Rate 71, 105

Setup Focuser 79

Setup Focuser... 86

Setup Telescope... 86

Sidereal tracking 103

Slew East Before Parking 110

Slew Rate 105

Solar tracking 103

Step Multiplier 82, 114

STOP 101

stop the mount's tracking 103

Swap E/W 101

Swap N/S 101

Sync Mount To PC Time 71

Synchronous PulseGuide calls 105

System Requirements 31

System T 86

System Tray 86

system tray icon 86

- T -

Telescope Setup window 55

TIME 81, 95

Time Zone 95

Timeout 60

TZ 95

- U -

Unpark 110
unpark from 63, 110
Unpark... 86
Use ASCOM Serial Object 60
Use RCAL for Sync's 105

- W -

What's New 28

Endnotes 2... (after index)

Back Cover